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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

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Forthcoming Events.

Institute of British Foundrymen.

JUNE 20-23.

Institute of British Foundrymen:—Annual conference in Cardiff.

The Iron and Steel Institute.

The Papers presented at the recent meeting of the Iron and Steel Institute are in some cases of particular interest to the foundry trade, and more generally a time is being reached when virtually all Papers on the metallurgy of steel must be considered by foundry metallurgists for any incidental light they may shed on the problems of cast iron and for any suggestions to which they may give rise in the mind of the reader.

On the blast-furnace side there are Papers on the external heat loss on a blast furnace and on the effect of removal of breeze on coke consumption. An American author reviews recent developments in American blast-furnace design and practice. Two incidental references in this Paper will interest those who think that "pig-iron is not what it used to be," and that hard driving is not beneficial from the point of view of quality of the pig-iron. He refers to certain German furnaces producing as large tonnages per day as are produced from American furnaces of half as large again hearth area by supplying them with as great a blast volume. He says that the American furnaces are not blown harder to give a proportionately greater tonnage (although this is possible), because the American pig, mainly for acid steel, has to be a higher quality than need be used in the German basic process. Secondly, he says that "slow blowing" resorted to in America during the present period of low demand, by reducing blast volume, has given more regular and better iron.

On the cast-iron side, Mr. J. E. Hurst has a Paper on the effect of phosphorus on hardened and tempered cast iron, which studies the effect of phosphorus from hematite value to over 1.5 per cent. An interesting feature is the use of variation of gap in a piston ring as a measure of internal stress after casting, hardening and tempering. The changes occurring in the gap as a consequence of heat-treatment will furnish the metallurgical wizards with something to explain. On the steel-casting side there is the first report of the Steel Castings Research Committee, a purely founding report which will doubtless receive an interesting discussion from the experts. The conclusion arrived at applies equally well to ironfounding, that the rigid application of scientific principles is difficult because every new design is virtually a distinct and individual problem in itself, and that even when the fullest data are available, an element of judgment will remain indispensable.

Sand Testing.

We are not concerned with the merits or weaknesses of the various apparatus available for the testing of the properties of moulding sands, but what does interest us very profoundly, as representing the ordinary man in the foundry, is the popularisation of figures denoting these properties. At the moment, the volume of opinion is divided into two schools of thought of roughly equal strength, and work is proceeding with the object of reinforcing the opinions of each side.

Normally, these experiments would make for progress, but we are inclined to the view that at the moment they are making for chaos. We are aware that the Report of the Sand Committee of the Institute of British Foundrymen, to be presented to the Cardiff Conference, will not be unanimous, but we have hopes that the views of the "man in the foundry" will be taken into consideration. His fundamental requirements are (1) the creation of standards carrying with them the widest field of comparative utility and (2) nationally-accepted standardised apparatus for the production of these figures. At the moment there are no really important industrial interests at stake, nor is there anything in either school of thought other than a general desire to promote the welfare of the foundry industry.

We are unaware as to whether there is any general desire to take the matter to the British Standards Institute for ultimate standardisation, but we would counsel complete agreement within the industry before any such step is taken. Moreover, after full ventilation of the existing position, which we hope will result from the Cardiff Conference, the leaders of thought should then be able to gauge public opinion, act accordingly and so to adjust differences that unification is at least provisionally reached. It would help the solution if interested parties would bear in mind in their discussions that real economies follow in the wake of systematic testing, that the settlement of the points in dispute is urgent, and that the Dominions in several cases are waiting for a lead.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Heat Reactions in Treatment of Cast Iron by Soda-Ash.

To the Editor of The Foundry Trade Journal.

Sir,—Mr. J. K. Smithson's letter in your issue of April 20 suggests a different method of attack, whilst recognising my contention that the oxidation of silicon plays a vital part in the soda-ash treatment of cast iron. If the sulphur and silicon removal takes place in the manner suggested by the reaction:—

$$2MnS + 2Na_2O + Si \rightarrow 2Mn + 2Na_2O + SiO_2$$

64 lb.	28 lb.	124 lb.	60 lb.
S	Si	Na_2O	SiO_2
0.04 lb.	0.0175 lb.	0.0775 lb.	0.0375 lb.

the ratio of the S and Si removal would be constant = 0.04 : 0.0175 2.38 : 1.0

This is not the case in actual practice, for in the instances cited A, B and C the S:Si ratios are:—

In A 0.01 : 0.2) or 1.0 : 20.0 (cupola addition).
B 0.03 : 0.15 or 1.0 : 5.0 (ladle addition).
C 0.05 : 0.10 or 1.0 : 2.0 (ladle addition).

the weight of soda-ash used being the same in each case (1 lb. per 100 lb. of cast iron treated).

Mr. Smithson's suggested reaction would mean that only 0.132 lb. of soda-ash would be required to remove 0.04 lb. S and 0.0175 lb. Si from 100 lb. of cast iron.

Experience shows that the ratio of S to Si removal is influenced by the temperature of the metal at the cupola spout and that the Si oxidation, commenced in the coke bed, continues as the metal flows into the ladle for, generally, the metal temperature and fluidity increase with the Si content.

Any SiO_2 formed during the contact of the metal with the air is accompanied by exothermic action and the writer remembers a practical application of this action by Mr. Henri Harmet of St. Etienne who, by causing an air jet to impinge on the metal stream issuing from a heated ladle or receiver raised the metal temperature by oxidising part of the silicon content of the iron.

There is a practical reason, therefore, for assuming that free SiO_2 is formed before this unites with nascent Na_2O after this is dissociated from the original soda carbonate, to form the mobile silicate—which plays so important a part in carrying off the light sulphides of Mn and Na.

It may be recalled that in the Heaton process molten cast iron was poured upon sodic nitrate, the records showing that the original pig-iron of approximate analysis:—

T.C.	Si	Mn	S	P
per cent.	per cent.	per cent.	per cent.	per cent.
2.83	2.95	0.32	0.11	1.45

was refined by means of the nitrate process to steel of:—

T.C.	Si	Mn	S	P
per cent.	per cent.	per cent.	per cent.	per cent.
1.0	0.15	0.09	Trace	0.29

The cupola can be considered as a gentle Bessemeriser and, when the molten product is treated with soda-ash, proceeds still further in the direction of a pneumatic refining furnace.

It is of interest to note that in the old Heaton process the weight of sodic nitrate used was about 10 per cent. of the cast iron treated, the rapidity of the reactions being such that in 8 or 10 minutes the molten cast iron was converted into crude steel. The sodium flame appeared in 6 or 7 minutes after pouring the molten iron on to the bed of sodic nitrate.

In my article the function of the sodium flame was shown to be most active when the soda-ash required for the S and Si reactions together is less than 0.8 lb. per 100 lbs. of metal treated.

I agree with Mr. Smithson that the whole of the heat liberated in the flame reaction may not be absorbed by the molten treated metal, but my observations point to benefits derived by using an excess of soda-ash over the theoretical requirements demanded by the S and Si reactions—the effect on the slag being clearly seen after the drop of the flame.

The fact that silicon is removed should not militate against the use of the soda-ash treatment when dealing with low Si refined irons, as the percentage of Si removed diminishes as the initial Si content in the cast iron is lowered.

It has been noticed, however, that the removal of sulphur in low-silicon iron of high-sulphur content is not so easily controlled and appears to be due to the fact that relatively less silicon is removed—with a corresponding diminution of the exothermic desiliconising action so necessary for the removal of sulphur by the soda-ash process.

After careful consideration of Mr. Smithson's arguments, I see no reason to question the sequence of reactions described in my article, as the methods used have enabled me to correlate the actual results obtained in practice with the thermochemical reactions and to visualise the mechanism of such reactions.—Yours, etc.,

J. E. Fletcher.

11, St. James's Road, Dudley.

The Foundry Exhibition.

To the Editor of The Foundry Trade Journal.

Sir,—At the close of the International Foundry Trades' Exhibition which has just been held at the Royal Agricultural Hall, London, I would claim the indulgence of your columns to be allowed to express to you and to all our supporters the great sense of indebtedness which both the Foundry Trades' Equipment and Supplies Association, Limited, and my company, F. W. Bridges & Sons, Limited, feel for the loyal and unstinted co-operation we have received.

In contra-distinction, however, to the spirit of mutual helpfulness displayed by all exhibitors, both towards one another and the management, I have been most sorry to notice unmistakable evidence of behaviour the reverse of sporting on the part of certain members of the trade. Any manufacturer or supplier to foundries is, of course, perfectly at liberty to determine for himself whether he wishes to support the trade organisation and the trade exhibition, and no one can blame him if for any reason he does not see his way to do so. We do, however, feel that we are entitled to expect that a manufacturer or supplier who is perfectly eligible to take part in both these enterprises and who elects not to do so should most scrupulously abstain, to put it mildly, from giving the universal impression of attempting to benefit from these undertakings without contributing to them. I am sure that any of our exhibitors, who had every reason to be proud of their displays, would be quite willing that these should be inspected by their competitors, but I trust you will agree with me that for firms to send their representatives on practically every day of the Exhibition to spend their time in conversation—no doubt about the weather—with prospective customers, is a source of legitimate irritation to those who have spent considerable sums of money to ensure what is generally admitted to be the great success of the Exhibition. We can take some consolation from the thought that to any fair-minded foundryman such behaviour can but bring its perpetrator into contempt, but we feel that nothing more than bare justice would be done by your allowing us to draw public attention to this abuse at this junction.

With apologies for having to trespass upon your hospitality.—Yours, etc.,

K. W. Bridges (Director).

F. W. Bridges & Sons, Limited,
Organisers of the International
Foundry Trades' Exhibition.

Dr. W. H. Hatfield.

BESSEMER GOLD MEDALLIST FOR 1933.

Dr. W. H. Hatfield was presented by Mr. W. R. Lysaght (President of the Iron and Steel Institute) at the annual meeting on May 4 with the Bessemer Gold Medal for 1933, in recognition of his distinguished services in the advancement of metallurgical science and of his valuable researches in connection therewith. Dr. Hatfield is the director of the Brown-Firth Research Laboratories and technical adviser to Messrs. Thos. Firth & John Brown, Limited, of which firm he is a local director. He studied metallurgy under Prof. Arnold, and became Mappin Medallist and Associate of Sheffield University College in 1902, and was awarded a Carnegie Scholarship. He commenced his works career in the laboratory of Messrs. Henry Bessemer & Company, Limited. After two years he went to Messrs. J. Crowley & Company, Meadow Hall Works. In 1915 he assumed control of the Brown-Firth Research Laboratories, and was adviser to Messrs. Thos. Firth & Sons, Limited, and Messrs. John Brown & Company, Limited.

Dr. Hatfield was awarded the degree of Doctor of Metallurgy of the University of Sheffield in 1913. He was the first President of the Sheffield Association of Metallurgists and Metallurgical Chemists, and he is well known as a lecturer on all subjects connected with the technical side of the iron and steel industry, having appeared before all the leading societies in this country and many abroad. His book on "Cast Iron in the Light of Recent Research," which first appeared in 1918, is a recognised standard work on the subject. In 1928 he was invited to give, before the American Society of Steel Treating, the year's memorial lecture to Prof. Campbell at Philadelphia. Dr. Hatfield has been one of the most eminent research workers in the rustless-steel field, and has done much towards applying the use of this material to practical ends and extending its use for commercial purposes. He has done valuable investigation work in connection with the special committees of the Iron and Steel Institute on "Heterogeneity of Steel Ingots" and "Corrosion," of both of which committees Dr. Hatfield is chairman. He also occupies the position of Vice-President of the Institution of Chemical Engineers. In addition to membership of numerous technical and scientific institutions, he is a member of the Council of the Iron and Steel Institute and also of the Industrial Research Council of the National Federation of Iron and Steel Manufacturers.

Dr. W. H. Hatfield.

His earliest Papers dealt with acid open-hearth practice, and were in collaboration with Prof. McWilliam. Later his work dealt with cast iron and malleable cast iron, while during the last 18 years he has necessarily been interested in all the technical problems with which a large armament firm such as the one with which he is associated is concerned. Several rustless steels now in large demand are the result of the researches carried out at the Brown-Firth laboratories under Dr. Hatfield's direction. His work on the properties of steel at high temperatures is well known.

The Iron and Steel Institute.

ANNUAL MEETING IN LONDON.

The Annual Meeting of the Iron and Steel Institute was opened on Thursday, May 4, at the Institution of Civil Engineers, Great George Street, Westminster. Colonel Sir W. Charles Wright, Bt., K.B.E., C.B. (retiring President), occupied the chair at the outset.

Report of Council.

The Council of the Institute, in their report, state that during the past year, 41 new members and 17 associates were elected; nine associates were transferred to membership, and five members were reinstated. One hundred and one members resigned their membership during the year, and the names of 43 members were removed from the register owing to the non-payment of their subscriptions. The total membership of the Institute on the register on December 31, 1932, was accordingly as follows:—Patron, 1; honorary members, 21; life members, 77; ordinary members, 1,751; associates, 44, a total of 1,894.

Referring to the deaths of 22 members during the year, the Council put on record their sense of the great loss sustained by the Institute through the death of their colleague, Dr. Arthur Cooper (whose name will always be associated with the early development of the basic-Bessemer process). He joined the Institute in 1874, and since 1894 had served on the Council, being elected Vice-President in 1906 and President in 1912. Count de Zubiria, whose death was recorded, will be specially remembered on account of the magnificent hospitality extended by him as President of the Reception Committee at the meeting of the Institute held in Bilbao in 1928, on which occasion he was elected an hon. member. Mr. Comm. Ing. Carlo Vanzetti, C.B.E., who also died during the past year, was likewise a great supporter of the Institute and played an important part in making the the arrangements for the meeting held at Milan in 1923.

Andrew Carnegie Research Scholarships.—On the recommendation of the Carnegie Research Committee, grants were made by the Council in 1932 to the following candidates:—J. W. Cuthbertson (Victoria University, Manchester), £50, in aid of a research on the rapid determination of the fatigue limit of ferrous metals with special reference to tests at elevated temperatures.

N. M. H. Lightfoot (Heriot-Watt College, Edinburgh), £100, for the purpose of carrying out mathematical investigations into the behaviour of steel ingots during cooling.

R. Mitsche (Leoben, Austria), £50, in aid of a research on the flotation of non-metallic inclusions in liquid metals.

M. Riddihough (The University, Sheffield), £50, in aid of a research on the equilibrium of the systems iron-phosphide/iron-sulphide, and iron-phosphide/manganese-sulphide. (The report to be a contribution to the forthcoming reports of the Ingot Committee.)

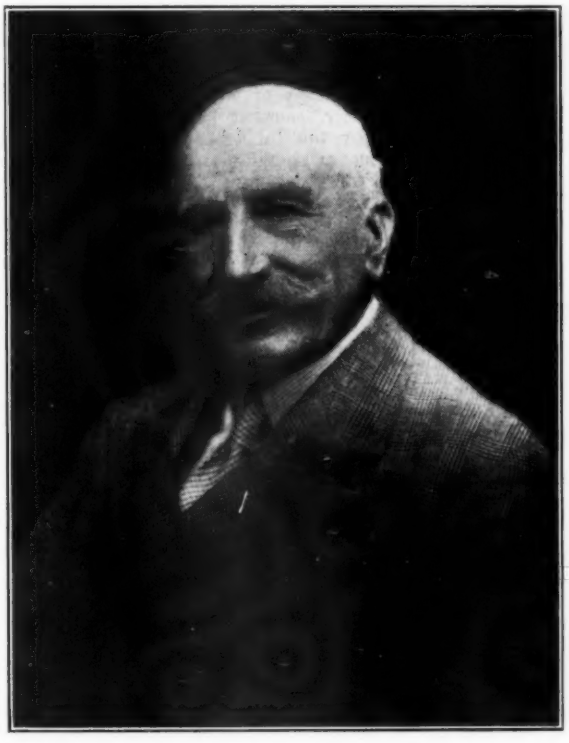
A. Scott (Newport Ironworks, Middlesbrough), £50, to carry out a research on arc-welded joints.

C. Rowley (British Cast Iron Research Association, Birmingham), £50, to study the effect of composition and microstructure on the corrosion of cast iron.

Brynmor Jones (University College, Cardiff), £50, in aid of the further investigation of the nitrogen hardening of steels.

W. Kleinefenn (Technical High School, Aachen), £50, in aid of the further investigation of the metallurgical conditions of welds (gas welds and electric welds).

Changes on the Council.—Mr. A. Dorman was elected Vice-President in place of Mr. W. Simons, deceased. Mr. V. B. Stewart, C.B.E., retired from the Council. The two vacant seats on the Council were filled by the election of Captain H. Leighton Davies and Dr. A. McCance. Mr. A. Dreux was elected an Hon. Vice-President, and Mr. J. E. James was appointed to serve on the Council in his place.



Mr. W. R. Lysaght, J.P., C.B.E.
(President of the Iron and Steel Institute).

In accordance with Bye-Law 10, the names of the following Vice-Presidents and members of Council were announced at the Autumn Meeting as being due to retire at the Annual Meeting in 1933:—Vice-Presidents: Dr. C. H. Desch, F.R.S.; Mr. Arthur Dorman; Mr. George Hatton, C.B.E. Members of Council: Captain H. Leighton Davies; Lieut.-Col. Sir Maurice Bell, Bt., C.M.G.; the Rt. Hon. the Earl of Dudley, M.C.; Captain R. S. Hilton; Mr. W. G. Gray. No other members having been nominated up to one month previous to the Annual Meeting, the retiring members were presented for re-election.

Induction of New President.

Sir Charles Wright, the retiring President, then asked Mr. W. R. Lysaght to take the presidential chair. In doing so he thanked the members of the Council and all the members of the Institute for the kindness they had shown him during his two years of office. To all the members, and especially to Sir Harold Carpenter, and to Mr. Lloyd and his excellent staff he should for all time be grateful.

It was a real pleasure for him to hand over the Presidency of the Institute to Mr. W. R. Lysaght, who was not only a very old friend of his, but one who had for very many years done so much to help forward the iron and steel trades not only in this country but also in other parts of the British Empire. In asking Mr. Lysaght to take the chair he desired on behalf of the Council and members to wish him a very happy term of office.

Mr. Lysaght was then inducted into the chair amid applause.

Mr. W. R. Lysaght thanked the members very sincerely for his reception. Sir Charles Wright was an exceedingly difficult man to follow, but he would do his best to follow in the high traditions which Sir Charles and his predecessors had set.

Sir Robert Hadfield said it was his pleasant duty to move a vote of thanks to the retiring President (Sir Charles Wright) for his able conduct in the chair. The members owed a deep debt of gratitude to Sir Charles for the painstaking way in which he had laid himself out to advance the interests of their Institute. Sir Charles had visited Paris in connection with the very important ceremony relating to the Jubilee, in France, of the Thomas and Gilchrist process, and he (Sir Robert) had heard nothing but the highest praise at the manner in which Sir Charles had acted on behalf of the Institute. The members trusted that Sir Charles would have the best of health in his very important work which he carried on in the iron and steel trade of this country.

The motion was carried by acclamation and Sir Charles Wright briefly replied.

Presentation of the Bessemer Gold Medal.

The President (Mr. W. R. Lysaght) said it fell to him as his first duty to present the Bessemer medal to Dr. W. H. Hatfield. He was sure that everyone would agree that Dr. Hatfield's title to the medal was indisputable, for by his scientific investigations he had opened up the way to new developments of great practical and industrial importance. His first published researches, on the physical chemistry of the acid open-hearth process, made in collaboration with the late Prof. McWilliam, were given to the Institute in 1902. He was then at the age of 20. Subsequently, as a Carnegie scholar, he studied the influence of the condition of the carbon on the properties of cast iron, and in 1907 he demonstrated that malleable cast iron might be produced with an elongation of 15 to 20 per cent., the ruling characteristic up to that time being an elongation of only 3 to 6 per cent. In 1916 Dr. Hatfield became director of the Brown-Firth Research Laboratories, where he soon found full scope for his talents. His work had become well known in connection with the development of rust and acid-resisting steels and heat-resisting steel. His chief title to renown as a metallurgist was, however, due to the part played by him in initiating and accomplishing researches which led to his being the first to demonstrate the special qualities of the material now universally known as the 18/8 austenitic chromium-nickel-alloy steel. Later he also fixed the composition of the more ductile 12/12 alloy. The pioneer investigations of the conditions causing the phenomenon of intercrystalline corrosion of the 18/8 steel was successfully carried out by him

in the Brown-Firth Research Laboratory, and he was the first to indicate the possibility of counteracting that tendency by the addition of other elements.

Continuing, the President said that Dr. Hatfield had rendered services of singular value to the Institute itself by the formation of the Committee on Heterogeneity of Steel Ingots, whose reports were familiar to the members. This was followed in 1928 by the formation of the Corrosion Committee, and the work of both these Committees was now being carried on with the active help and support of the Iron and Steel Research Council under the auspices of the National Federation of Iron and Steel Manufacturers. In a great measure Dr. Hatfield had succeeded in co-ordinating and developing co-operative research within the industry, and had promoted a general spirit of collaboration which was so important a factor in industrial progress. In pursuing his scientific work he had ever kept the practical end in view, and he had fully justified his calling as a scientific metallurgist by the success which he had obtained by the introduction of new commercial products on a large scale.

He (the President) then handed to Dr. Hatfield the Bessemer Medal with his good wishes and congratulations.

Dr. Hatfield said he really did not know what to say in reply to the President's kind remarks. As being at one time the youngest member of the Institute, the members would appreciate that the present must clearly be the greatest day of his life in having such an honour bestowed upon him. With regard to the schedule of work, if he might call it so, with which the President had credited him, he should like to say that in his early days quite clearly an investigator's work was essentially single-handed; but when one took control of a large research laboratory the work which issued from that laboratory was necessarily collective work, and he therefore took the presentation of the medal as being a compliment to the research laboratories as much as to himself. The last phase to which the President had referred in connection with his work had been the duties of the technical committees with which he was associated. He could assure the members that the work of those committees was really unique and of almost an indigenous character, as regarded this country, in the sense that there were now the Ingot Committee, the Corrosion Committee, the Rolling Committee and the Iron and Steel Institute and the Federation all working in sympathy, and in such a spirit that it was perfectly true to say that no man attended any of those committees who was not fully prepared to place on the table the full technical knowledge of the processes with which he was associated. By that very intimate exchange of data and information there was being produced a very rapid development of the technique and technology within the British iron and steel industry. He therefore would again like to think that the medal was some recognition to the committee with which he was associated and to his colleagues on those committees.

Continuing, he said that he desired to say one thing more. The Institute had had a sequence of distinguished Presidents, each one in their turn adding to the dignity and lustre of the Institute. It had a more permanent individual in its distinguished Treasurer, who took a benevolent interest, from the financial point of view, in the work of the various committees and who also was of great assistance from his scientific insight; but might he point out that the country, as indeed most things, was run by permanent officials in a large measure, and in their own case they had been very fortunate in having Mr. Lloyd as their Secretary. For his own part, all through his scientific life in connection with the Institute he had had Mr. Lloyd as a guide and a friend, and in the work of the committees he could assure the members that Mr. Lloyd's guidance and assistance had been of inestimable value. He welcomed the present opportunity of recording that fact.

Presidential Address.

Mr. Lysaght then delivered his Presidential address, which we append slightly abridged:—

Those who remember the Iron Age are getting very scarce, and it has occurred to me that it may be of interest—especially to the younger members of the Institute—if one who, as a principal, has been actively engaged in the sheet trade longer probably than any other living person in the world, were to record some of his earlier experiences.

I started my career (continued the speaker) in the autumn of 1874 at the works of the Gospel Oak Company in Tipton, Staffordshire. This company was then the principal maker of galvanised iron, and their brands were of great repute. I have a copy of an invoice, dated a few months earlier, showing the then current price of £60 per ton for 26-gauge galvanised iron. The immense stimulus given to the iron trade by the Franco-German War was just subsiding, and prices, which had soared to a level comparable with that reached in 1920, were beginning to fall heavily.

At this period, there were some 120 blast furnaces, thousands of puddling furnaces, foundries, chain and nail factories and works making all sorts of rolling-mill accessories. Staffordshire, as it appeared by day, was then rightly called the Black Country. At night, it was very different. All the blast furnaces and half the puddling and mill furnaces had open tops, with the result that a lurid and almost uncanny glow was cast over the whole district. The reflection on the clouds could be seen more than 20 miles away.

The Day of Individualism.

Individualism was the keynote in those days. There must have been at least 300 firms manufacturing various forms of iron, and there were 40 sheet works, averaging less than four mills each. The number of these small units in operation then and for some years afterwards was undoubtedly due to the small cost at which they could be erected. £20,000—about one-quarter of to-day's figure—was a fair estimate for a four-mill plant, including its complement of puddling and ball furnaces. Many managers and foremen, who had saved a little money, joined hands with the local grocer and butcher and started works. Brothers, uncles and cousins held all the principal posts. Even the roller was often a relation, who made substantial sums by sub-letting the work at less than the so-called country rates.

Sheets were produced then from bars rolled out from "piles" in a type of bar mill at the end of the train. The pile generally contained five pieces, three inside of puddled iron, with a top and bottom piece made from scrap. The scrap bars were of great importance, as they checked many surface defects that would otherwise have been evident. Almost every forge manager had his own special mixture of pig-irons. Supplies were obtained largely locally, but for the better-quality sheets iron from farther afield—such as Barrow, Yorkshire, Forest of Dean and Shropshire—was obtained. Eight half-pigs, weighing 4 cwts., made up the charge, and six heats were worked in 12 hrs. Later on, the weight of the charge was raised to 5 cwts.

A Pre-Chemistry Age.

Chemistry, in the average works, was almost unknown. The manager, in addition to his secret selection of pig-iron, had in most instances a nostrum that he applied, under the name of "Physic," to the melted charge. It was generally a spoonful of some innocuous substance that had no appreciable effect, except on the self-importance of the man himself. Oxide—pronounced "ogzide"—and sulphur were the only words ever heard. To these two terrible enemies almost every fault in quality was attributed. It was not until the introduction of steel that any intelligent interest manifested itself in connection with analytical problems.

The boilers—which were known as Rastrick boilers—were vertical, and worked at a pressure not exceeding 30 lbs. Waste heat from the puddling furnaces was utilised, each boiler being attached to four furnaces. The engines were mainly of the beam type, with large cylinders and a long stroke, the drive being taken through a train of gearing. In addition to driving the mill, the engine had to work the helve-hammer, the cutting-down and finishing shears, and the pump. Scares were not uncommon, for if an accident happened to the engine the boilers could not be fed, and the men, after drawing the furnace bars, rushed out of the works. I have experienced several of these panics, and while I remained in the works and pretended to be brave, I am afraid I must admit it was only pretence. Boiler explosions, with much loss of life, had occurred at not very long intervals in the district, and the men found them hard to forget.

Extended Week-Ends.

Starting the works on Monday mornings was seldom attempted, as the men had not sufficiently recovered from their week-end rejoicings. Things rapidly improved, however, and for many years there has been no difficulty on this score. Work was very strenuous. Twelve-hour shifts were the order of the day at the puddling furnaces and in the mills. There were no mechanical devices for transferring the iron to the hammers and the rolls, and no cooled floors or heat-resisting appliances. The skill of the shingler, or hammerman, was a pleasure to see; he welded the end of his staff to the puddled ball, and then forged the mass into a slab. He had no control of the helve, which weighed about 4 tons and was operated by a cam on the engine, and consequently any error in manipulation on his part caused the bloom to shoot dangerously across the standing. Of course, the introduction of the steam hammer simplified this operation.

"Knocking-off" time was four o'clock on Saturday, and the men were paid once a fortnight. Later on, a "draw" was given on alternate weeks. Five o'clock was not an unusual hour for the office to be open on that day. The Staffordshire men on the whole were excellent workers. In the 'eighties a boat-load of coal, weighing 30 tons, would be unloaded for 6s., and wheeled, in barrows, a distance of 50 yds. to the puddling furnaces. Similarly, 25 tons of pig-iron would be discharged and each pig broken for the same sum. A ton was then 2,400 lbs. Coal, like silver in the days of Solomon, was not much "accounted of." At times the cost was 5s. per ton for large and 2s. per ton for small, at the pit. It was conveyed to the works in barges. The weight of the coal in the barge was determined by a gauging-stick. The boats were supposed to draw 9 in. of water, but by constructing them of deal they could be made to float in 7 in. One therefore got 3 tons or more of coal before the stick registered anything. Again, as 2 tons overweight was allowed, and 2,400 lbs. went to the ton, one got at least 30 tons and only paid for about 24. Naturally, this became known to the sellers, but it shows the extent to which they were prepared to go to attract trade.

Prices of Pig-Iron.

Common pig-iron was at times very cheap too. I have known what was called cinder pig sold at 23s. per ton. This was made from tap cinder from the puddling furnaces. We used often to give the blast-furnace boatmen a bribe to take the stuff away, never thinking that it would one day be worth £1 per ton.

The scrap dealers in those days required watching. Many of them were cunning bribers, and the temptations of the weighing-machine men were great. Nearly all the scrap was delivered by cart, and the horses were specially trained to sit on the backband to increase the weight

of the load. Except for this and a few other commodities, everything was carried in and out of the works in barges. Very few of the plants had railway sidings. Staffordshire was a network of canals, and was so dependent on this method of transit that a prolonged frost brought the industry to a standstill. I remember one occasion when ice difficulties caused a complete closing-down for three weeks.

Unfortunately, the men in those early days had few amusements. Music halls were scarce, and there were, of course, no cinemas. Football was only in its infancy, and the bar parlour of the public-house—there were seven within a quarter of a mile of our works—was the principal centre of attraction. One used to hear whispers of dog- and cock-fighting, and arguments concerning how many rats a Staffordshire terrier could kill in a limited time. I should say that, for many years, the men on the whole drank too much. It made them neglect their work, and eventually shortened their lives. A pint of beer after every heat was not unusual, and I am afraid that we often took advantage of their fondness for this excellent beverage. For a quart of what they called "'lowance," one could get work done that no promise of recompense in money on pay-day would have effected. We always had barrels on tap for use whenever we had difficulties to contend with.

A Vanished Tendency.

This tendency to imbibe too much, as I have mentioned before, made it inadvisable to attempt to start the works on Monday mornings. It also rendered social gatherings, where drink was provided, rather difficult and painful, as some took too much and marred the entertainment. It is a great satisfaction to know that this state of things has entirely disappeared. Year by year, for the past 50 years, the improvement has manifested itself. I think I can safely say that if, to-day, we gave our 3,000 men at Newport a dinner with all they wanted to drink, not one would disgrace himself. Self-respect and not prohibition has done this.

Both during my earlier days at Swan Garden Works, Wolverhampton, which I propose to mention again a little later, and my more recent years at Newport, I have always endeavoured to promote good-fellowship by taking an active interest in the amusements of the men. Occasionally, this has entailed some little sacrifice. For instance, in 1880, the men expressed a wish to start a brass band. The firm paid for the instruments and uniforms, and the players were selected from the works. I was begged to be a member, and, acceding, was given a cornet. We met once a week at 8 o'clock for practice, and for two years I attended regularly. I knew nothing about a cornet, and could hardly read a note of music, but the noise of the combined band of twenty brass instruments was so loud that I simply blew down my cornet and let it make any sound it chose. A sore lip proved that I had been working. It became a good band in time—it is still in existence—but after I had finished playing my part.

Educational Efforts.

In those days, very few of the older men could read or write, and we instituted early Sunday-morning classes to try and teach the rudiments of these attainments to those who wished to attend. Not much enthusiasm was displayed, the men maintaining that they and their fathers had got on very well without being "scholards" and that they could do the same. Later on, when compulsory education was established, there was much dissatisfaction among this class of parent. Children, a few years before this, went to work at a very early age. Our cashier began work in a nail factory at the age of seven, and only died a few years ago, aged ninety. Our forge manager began at the same age, and the mill manager at the age of nine. Parents were accustomed to look upon young children as a possible source of income.

The greatest day of the year was the annual outing to the seaside, at which I always tried to be present. A special train was engaged, and we started about 4 a.m., returning about 22 hrs. or so later. Weymouth was a favourite resort, as from there the men could go to Portland and catch a glimpse of the convicts at work or returning to prison. It was a great thing to catch sight of some notorious criminal they had heard about, or some one they had known. Incidentally, the date of the execution of the Rugeley murderer was a measure of time in the lives of many of the older men.

Between 1876 and 1900, several periods of acute trade depression were experienced. Soup kitchens had to be established to keep the children from starving. Halfpenny dinners were provided at our works and elsewhere for months, and the poverty was such that only those who witnessed it could believe it. Fortunately, these periods did not last very long, probably as they were insular and not world-wide as they are to-day.

To a young man, as I was in these early days, the life was a fine adventure, and satisfied the yearning most of us have to be connected with big things. Going round the works at night was like being in an enchanted land. None of your dull modern economical appliances, but a riot of escaping steam; flames from the furnaces and sparks from the rolls and hammers dominated the scene. There was no electric lights, and very little gas. The mist from the hot canals, into which condensed steam was fed, crept through the works at times and produced a most weird effect.

Roll Changing.

My connection with John Lysaght, Limited, actually commenced in 1878. Mr. John Lysaght, who for some years had been manufacturing galvanised sheets, in Bristol, from black sheets rolled in Staffordshire, bought Swan Garden Works—a part of Thornycroft's works in Wolverhampton—and I was sent there from Gospel Oak. Thornycroft's had been almost the most important works in the Black Country for many years. They rolled rails, plates, a few sheets and merchant iron. We converted some of the plant into sheet mills, until eventually we had seven—more than anyone else in Great Britain. All the mills at that time were what were called "single," that is, there was one set of rolls to each shaft. The diameter of the rolls did not exceed 20 in. The output of a mill was about 30 tons a week, and much of the annealing was done in the mill furnace. The roller was practically his own millwright. He turned, brassed, lined and changed his rolls. There were no overhead cranes, and a broken roll took six or more hours to replace, this being done by the crew for a nominal sum. In the absence of nearly all mechanical appliances, it is astonishing to think how the old engineers managed to manipulate the heavy weights they had to deal with, such as engine beams, flywheels weighing 60 or 70 tons, and other heavy castings which were erected with nothing much more than jacks and pulley blocks.

Improvements began to take place, but slowly. Double and treble mills were put down, and the diameter of the rolls was increased to 24 in. Overhead cranes were provided in the more modern mills, but the output still remained low at about 45 tons per mill. It was not until the introduction of steel in the middle 'nineties that the real improvement began. The abolition of "pile" heating and bar rolling; the increase in the diameter of the rolls; the heavier trains and more powerful engines; and, most important of all, the introduction of the 8-hr. shift, all added to the efficiency of the mill, and the output has kept steadily rising until to-day, when 100 tons per mill are normally being produced per week.

At first, we all had difficulty in getting large steel sheets to open, and much waste was made in consequence. I remember taking out a patent whereby two sheets of iron should be rolled in the pack with four sheets of steel. It worked successfully for a time, but as a result either of steel improvements or the men getting to understand better the proper method of heating, it was found to be unnecessary, and the practice was abandoned.

Migration to Sea-board.

By 1898, it was obvious that Staffordshire was doomed as a sheet-making centre, as practically all the steel bars were being rolled near the coast, and most of the sheets produced were being exported abroad. Several firms moved to the sea-board, and we migrated to Newport, while others gradually died away. To-day, out of some three hundred and fifty mills in the country, only about twelve remain in the Black Country, and these supply local industries.

Up to 1891, almost every sheet works paid their men on a different schedule of wages, and this naturally caused much dissatisfaction and suspicion among the employers and operatives. In that year it was agreed by the whole trade to form one schedule, and this was arrived at by taking an average of all the various rates. It meant an increase to some and a decrease to others, but on the whole it was very well received, and this schedule, with very little alteration, still prevails in every sheet works in Great Britain. The Midland Wages Board, which had been in existence for many years, regulated the percentages that had to be added to or deducted from the schedule from time to time by means of a sliding scale based on the selling price of bars and other irons at twelve selected firms.

The Midland Wages Board all through its career has done admirable work. It has been guided on both sides by men of wide and sympathetic views, and during the whole of its administration has not once resorted to arbitration or been involved in a strike or lock-out. Owing to the increasing growth of the industry, the sheet trade, about twenty-five years ago, formed its own Board on much the same lines as its parent, and I think I can say that the present organisation has been able to work so harmoniously and peacefully mainly as a result of the traditions we inherited from the old Board. I had the honour of being chairman of the Sheet Board for nearly 25 years, and this has been one of the greatest satisfactions of my life.

Roll Breakages.

Anybody who has had anything to do with a sheet mill is aware of the eternal controversy that wages on the question of breakages. Periods occur when the calamities are few, and periods when they are alarmingly many. One roll will last a hundred and fifty days, and another cast out of the same ladle, with identical analysis and chill, one day. The increase from 18 in. to 34 in. in roll diameters during the last 60 years has not materially reduced the casualties, as the work required of the larger rolls is so much more strenuous than was formerly demanded. Thousands of experiments have been made, and every variety of pig-iron tried, but no caster has yet made a roll that he is prepared to guarantee to last until it is worn out. I have had the advantage of being in charge of a roll foundry all my business life, as well as a user of the finished product, so that I can look at the matter from an unbiassed point of view. My considered opinion is that the great bulk of the breakages is caused by treatment received in the mill. Erratic preheating, abnormal variations in rolling temperatures, overscrewing, bad turning and other avoidable maltreatment cannot be inflicted upon a delicate and highly-strung body like a chilled cast-iron roll without disastrous results.

It may be interesting to refresh your memories here with a statement showing the growth of the sheet trade during the 60 years under review. These export figures speak for themselves:—1873, about 50,000 tons; 1883, 129,000 tons; 1893, 258,000 tons; 1903, 480,000 tons; 1913, 830,000 tons; 1923, 887,000 tons;

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1929, 993,000 tons. I have omitted the last three years, as they are, of course, quite abnormal. There is probably no branch of the iron and steel trade that has made such progress. Our own figures are:—1869, 2,600 tons; 1929, 180,000 tons.

Future of the Industry.

The question now is: What of the future? I must leave the answer to the young men who are following us, and will in time become the managers and principals of the industry. We have many brilliant contributors to our scientific and technical literature, and others who are energetically carrying out experimental work that may have far-reaching results. They should be taught the great importance of detail; to observe as they walk through the works what is happening in each department; to make friends with cost accountants, wages clerks, engineers and electricians; to be able to read a balance sheet, and so—apart from their own special subject—obtain a general knowledge of how a works is run. The rocks ahead that these young men will have to avoid are many and formidable. Foremost is the determination of so many of our overseas customers to manufacture sheets themselves. Australia, once our second largest buyer, is now making and will continue to make, all her requirements. India, that imported from us in 1929 250,000 tons, is now making half her needs (which at the moment are small), and talks of increasing her mills. Canada is now making a third of her wants, and will probably increase her output. South Africa is building a steelworks in Pretoria, and contemplates adding sheet mills to the plant. Japan, up to two or three years ago one of Britain's largest customers, is now producing almost all she needs, and is, in fact, exporting.

Again, during the last three or four years, we have been much concerned at the instalment and development of monstrous continuous-strip mills in the United States of America. These are reported to be capable of producing sheets up to 4 ft. or more in width at a rate of 1,000 tons in 24 hrs. Several of these mills have been erected at colossal cost, but whether they will eventually supersede the older type remains to be seen. The trading conditions in America have been so bad for the last two years that none of these mills has been able to run at anything like full capacity. The conditions prevailing in the States are very different from ours. They have in normal times a consumption of over 5,000,000 tons per annum, of which over one-quarter is in 20-gauge, the present limit in thickness of their continuous mills. Here, we have a capacity of 1,500,000 tons, composed of all gauges from 10 to 32, 60 per cent. being 24-gauge and lighter. With our present knowledge, it would be impossible in this country to run one of these giant mills profitably.

New Sources of Demand.

Against all these disturbing happenings, we have the cheering fact that sheet steel is being used for an increasing number of purposes. Motor-cars, furniture, electrical appliances, barrels, ceilings and concrete laths are all examples of comparatively new sources of demand, and others are springing up constantly. I look forward to the time when railway coaches will be all-steel, and, in order to avoid scares of fire at sea, there is no reason why passenger ships should not be panelled, doored and furnished in this material. Owing to the greatly improved working qualities of the modern steel sheet, engineers and stampers are demanding service from it that was impossible some years ago. This is all to the good, as it means that it will be substituted for other products. It would seem that we must be prepared to lose an important part of our galvanised-iron trade—galvanised sheets form 60 per cent. of our make—but, I think, when the world becomes normal, we may not without hope expect to make up for lost markets by a gradual increase of new uses for sheets at home, and by supplying overseas markets with qualities that they will probably not attempt to make for many years to come.

I have dealt unconventionally—and I am afraid without much sequence or method—with certain phases of the sheet trade that, in my long career, I have encountered. I now conclude with a reference to that part of it which, from my earliest days, has been a pleasure and a continual source of satisfaction to me, namely, my relations with the workmen.

I have always held that every man in the works should be able, if desired, to approach the managing director, or other head authority, for advice, sympathy or help, without giving offence to his departmental manager. This privilege is never taken advantage of unduly, and the men feel that they have a friend who will listen for five minutes to their short and simple annals. The directors of many of our large companies are hardly known by sight to their employees. This is not as it should be. The pathetic events that occur in the lives of many of our workmen can be largely alleviated by advice, sympathy and financial help in the form of small loans. It is astonishing how little is lost in bad debts. Recently, during a coal strike, we lent £50,000 to our Newport employees, and the whole of this sum was paid back in a few months.

A hearty vote of thanks was accorded to the President for his address, and the reading and discussion of Papers then followed.

Institute of British Foundrymen.

INSTITUTE ELECTS NEW MEMBERS.

At a Council meeting of the Institute of British Foundrymen, held at the International Foundry Trades' Exhibition, Royal Agricultural Hall, Islington, London, N.1, on Saturday, April 29, the following were elected to its various grades of membership.

As Subscribing Firms.

British (Guest Keen Baldwins) Iron & Steel Company, Limited, Port Talbot, Glam. (C. J. Burgess, representative.)

Hepworth & Grandage, Limited, St. John's Works, East Bowling, Bradford. (H. J. Young, representative.)

James Howden & Company, Limited. (C. E. Lumb, representative.)

Spencer & Halstead, Ossett, Yorks. (W. M. Oddie, junr., representative.)

Bagshawe & Company, Dunstable. (T. W. Bagshawe, representative.)

As Members.

C. H. Aiken, engineer, Allen Haughton & Company, Limited, London.

V. Aronovitch, foundry lecturer, Moscow Technical High School.

J. Berlyn, foundry manager, Thos. Firth & J. Brown, Limited.

W. H. Butler, ironfounder, W. H. Butler & Son, Dronfield.

J. Carruthers, works superintendent, E. Chainbelt & Company, Limited, Derby.

G. R. Gibbons, works manager, W. C. Holmes & Company, Huddersfield.

J. R. Platt, foundry manager, J. Williams & Sons, Widnes.

A. Young, secretary, British Bath Tube Company, Greenford.

Charles Benjamin Northey, instructor in foundry practice, Northampton Institute, London.

F. C. J. Nurcombe, managing director, H. G. Sommerfield, Limited, London.

William Frederick Rowden, metallurgical engineer, High Steel Alloys, Limited, Widnes.

William W. McCosh, managing director, Wm. Baird & Company, Limited, Glasgow.

James Robertson, works manager, Wm. Baird & Company, Limited, Glasgow.

William Baird Barbour, Shaw, Lovell & Sons, Limited, Glasgow.

T. Platt, iron and brass founder, J. Williams & Sons, Widnes.

R. E. Farrington, foundry foreman, Burn & Company, Howrah Ironworks, Bengal.

J. T. Gray, proprietor, J. Gray & Sons, enamelling engineers, 5, Victoria Street, London, N.W.9.

William Edward Sample, B.Sc., foundry foreman, Ford Motor Company, Limited.

Gustav Zimmermann, manufacturer, Dusseldorf.

William Tait, managing director, British Moulding Machine Company, Limited.

Norman Smith, foundry machinery salesman, British Moulding Machine Company, Limited.

As Associate Members.

Alexander Logan, foreman brass moulder, Meikle & Logan, Glasgow.

S. W. Hanson, foundry foreman, John Fowler & Company (Leeds), Limited, Leeds.

R. A. Williams, foreman moulder, Jackson Bros., Milton, Staffs.

T. Walker, assistant foreman, Bagshawe & Company, Limited, Dunstable.

Leslie George Hemsley, assistant chemist, Bagshawe & Company, Dunstable.

H. H. Bennett, foundry manager, Pontypool Foundry & Engineering Company, Pontypool.

E. Doughty, foreman moulder, Moston Malleable Company.

E. Sutcliffe, draughtsman, Craven Bros., Reddish.

J. Anson, coremaker, C. Walmsley & Company, Limited, Elton.

G. Ball, foundry manager, Western Foundries, Southall.

J. H. Bingley, works chemist, Harrison & Company, Hykeham, Lincs.

G. V. Cochrane, metallurgist, Royal Arsenal, Woolwich.

W. M. Collins, ironmoulder, North British Rubber Works.

T. N. Goodwin, foreman moulder, Smith & Wellstood, Limited.

H. Hall, moulder, J. Cox, Rutland Foundry, Ilkeston.

H. Hardy, foreman coremaker, Harrison & Company, Hykeham.

J. Kean, iron and steel moulder, Royal Ordnance Factories.

J. S. Kidd, assistant foreman moulder, R. & A. Main, Falkirk.

F. Marriott, steelfoundry foreman, Stockton Steel Foundry.

L. E. Richards, ratefixer, Stanton Ironworks Company, Limited.

F. Sanderson, foreman patternmaker, J. Stubbs, Limited, Ancoats.

W. Varney, steelfoundry manager, Parker Foundry (1929), Limited, Derby.

W. Walker, moulder, F. Wigglesworth & Company, Shipley.

H. H. Wells, foreman moulder, Ley's Malleable Castings.

C. Wight, ironmoulder, North British Foundry.

As Associate.

F. F. Mather, moulder, W. Foster & Company, Lincoln.

Catalogue Received.

Improving the Properties of Iron Castings.—Mainly for use at the recent Foundry Trades' Exhibition, Imperial Chemical Industries, Limited, of Imperial Chemical House, Millbank, London, S.W.1, prepared a 28-page booklet describing and illustrating the benefits to be derived from the soda ash treatment of cast iron. It places into the hands of foundry executive last-minute information as to how and why soda ash should be used. The lay-out is excellent; the illustrations are perfect, and the matter has been convincingly written and well printed. In short, it does credit to the standard of excellency that one now expects from the Publicity Department of this concern.

Intricate Steel Castings for Automobiles.*

By A. D. Kirby.

The very nature of the automobile industry demands castings of a minimum weight, coupled with a maximum strength. The automobile engineer is incessantly calling for castings so intricate in design, and so thin in section, that a few years ago it would have been thought almost impossible to produce them in steel.

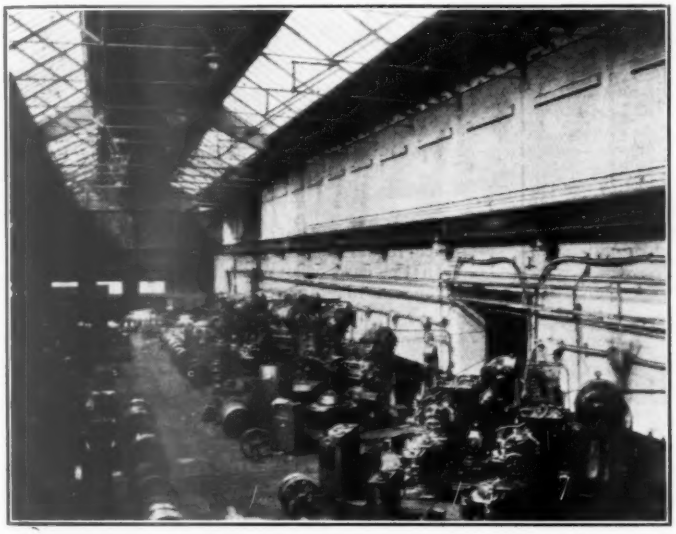

Fig. 1.—As the Principal Output from the National Steel Foundry (1914), Limited, is Heavy Vehicle Wheels, this Machine Shop has been Created for Machining the Wheels prior to Delivery.

Since the introduction of the electric furnace the steel founder has become possessed of a melting unit over which he has complete control. Being able to produce a steel conforming to the required analysis, and exceedingly fluid in nature, it is possible nowadays to produce steel castings no thicker in section than is usually called for in malleable-iron castings of similar design.

It is obvious that a foundry producing such castings as were shown by slides is faced with difficulties. The uneven sections are conducive to both liquid shrinkage and solid contraction troubles, and only experience can guard against these problems. Whilst it is possible to produce a large amount of work in green sand, some of the jobs have perforce to be made in dry sand. Delicate overhanging parts of the mould dare not be subjected to the erosion of the steel.

Block Cores.

To simplify the jobs, making them suitable for machine moulding, it is sometimes necessary to block out certain parts of the pattern and utilise cores. All such cores are made with an oil-sand mixture and prepared in a Spermolin mixer. Providing due care is taken with the drying of the cores very little trouble is experienced. It cannot be over-emphasised, however, the importance of correct drying. Over-baking gives a friable core with the distinct possibility of sand inclusions in the finished casting, whilst an under-baked core is simply asking for trouble in the form of blow-holes. Naturally, such an important part of foundry technique must be under complete control, and thermographs are attached to each stove. The man in charge of the stoves can thus tell at a glance the temperature of each stove.

A certain amount of discretion is required when loading up the core bogies. One cannot expect to get desired results if the cores are placed haphazard. The smallest cores are placed on separate bogies, and the others so distributed as to ensure their being correctly dried wherever placed. At the present time there are foundries using oil-sand cores where not the slightest pretence to drying them scientifically is practised. The benefit to be derived from the application of technical knowledge is in no instance more apparent than in the case of drying stoves. Unless the correct atmosphere and temperature be attained and maintained, oil-sand cores cannot be made successfully. Despite all the data available anent this matter, obsolete methods of drying oil-sand cores still obtain in some foundries. One of the features of a correctly-baked oil-sand core is the licence that is allowed in handling. Fragile cores can be handled with impunity.

Sand Conditions.

Generally speaking, greater freedom from tears in the casting is also experienced when using oil-sand cores. There are certain disadvantages in the use of such cores, notably the liability to "sagging," but here again by constant experience one is able to estimate the amount of allowance necessary to overcome this trouble. It has often been stated that oil-sand cores require no venting. Whilst this may be true in the majority of cases it has been proved in certain instances that the provision of artificial vents has overcome blow-hole troubles, unavoidable when the cores were not artificially vented. In view of such experience one cannot wholly subscribe to the view that oil-sand cores are entirely self-venting. To avoid any misconception it would perhaps be as well to amplify this statement by saying that the silica sand used has not a very large grain size. It is desirable to produce castings having a smooth surface, hence the necessity of using a sand not too large in grain size. The sand used by the Leven Foundry gives the results set out in Table I.

Table I.—*Sieve Tests on Silica Sands.*

Left on 30 mesh	..	..	..	0.30
Through 30 ,,	..	..	..	1.45
40 ,,	..	..	..	73.05
60 ,,	..	..	..	20.85
80 ,,	..	..	..	1.00
90 ,,	..	..	..	0.25
100 ,,	..	..	..	1.45
120 ,,	..	..	..	1.70

Having a large variety of castings to manufacture, it is an economic proposition to make a number of the smaller castings in the form of core assembly. Besides eliminating the need of a large box plant, one has the added advantage of a mould easy to handle in all its stages. Made on turnover jarring machines, these moulds are placed on roller conveyors, and the necessary finishing touches applied to them. They are then easily transferred to the core bogies and then placed in the stove. Incidentally the drying costs for jobs made in the form of core assembly are considerably less than they would be if the same jobs were made in moulding boxes. The casting bay for the core assembly work being adjacent to the core-making bay, a minimum amount of handling is required. Fig. 2 shows a general view of the core shop, and Fig. 3 a number of core assemblies ready for closing.

Fig. 2.—General View of the Core Shop, National Steel Foundry, Leven.

Hub Castings.

Figs. 4 and 5 show the location and size of runners and feeder heads is a most important feature. No hard-and-fast rule can be laid down regarding the correct positioning of runners, for whereas best results are obtained in some instances when run from the bottom, other jobs

* A Paper read before the Scottish Branch of the Institute of British Foundrymen, Mr. A. D. Campbell presiding.

somewhat similar in design give best results when run from the top. A typical example of this occurs in hub castings, and Fig. 4 shows a front hub run from the bottom and Fig. 5 one run on the flange.

It is not easy to explain why defects occur when running these hubs other than shown. Some of these particular castings can be run

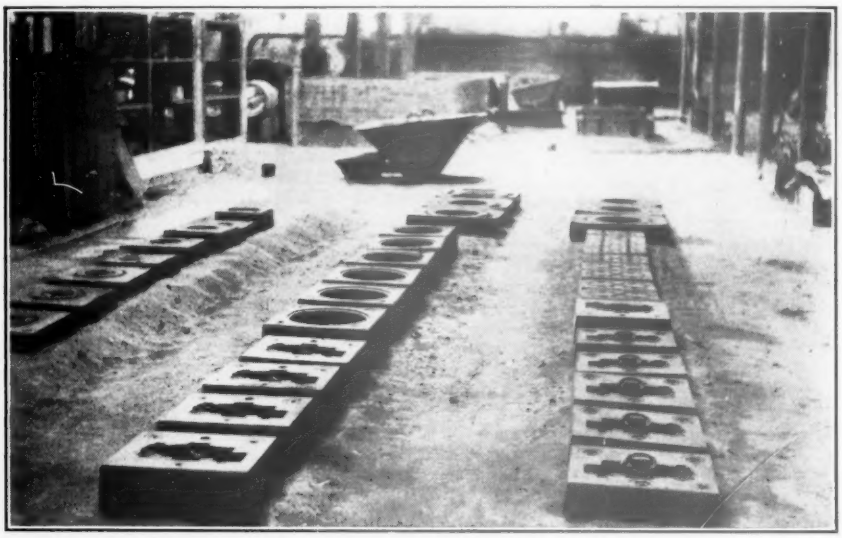

Fig. 3.—A Number of Core Assemblers Ready for Closing.

with absolute safety from the top and be entirely free from blow-holes or sand inclusions. With other jobs somewhat similar in design these defects are liable to occur. On the other hand, some can be run from the bottom of the hub quite safely, whilst others when run from the bottom are susceptible to draws. A similar state of affairs occurs when running on the flange. Fig. 6 shows sections of a front hub run from the bottom and sieve-run. In the majority of cases such hubs are cast with the flange down as shown, but Fig. 7 shows a similar hub with the flange cast uppermost.

Determining the correct size and shape is quite as important as the correct positioning of runners. The total inlet area should never exceed the area of the down runner. In fact, there should be a gradual decrease of the inlet area from the end of the down runner to the entry into the casting. Likewise the area of the down runner should not be in excess of the stopper. Certain jobs may require more than one inlet to ensure their being correctly cast, but if the total inlet area is greater than the area of the down

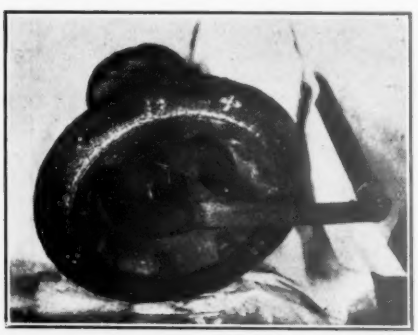

Fig. 4.—Hub Casting Run from the Bottom.

runner it certainly follows that the inlets cannot function properly. If some of the inlets are only partially filled, or receiving intermittent flows, there is always the possibility of particles of sand being pulled in from the top face of the inlet, thereby passing along with the steel into the mould. Sand inclusions in the casting can most probably be traced to this cause.

Wheel Castings.

Figs. 8 and 9 respectively show a front-wheel centre and a rear-wheel centre. Both of these jobs are cast green sand; the weight of the former as cast being 1¼ cwts. and that of the latter 3 cwts. The spoke section in the rear-wheel centre being only ¼ in., it is easily understood that a very fluid steel is essential to run this particular job.

Fig. 10 shows the bottom half of the rear

Fig. 5.—Hub Casting Run from the Side.

centre mounted on a turnover jarring machine and Fig. 11 shows the top half of the same job.

Figs. 12 and 13 show the top and bottom parts of the rear centre after being taken off the machine. It will be observed that a perfectly true draw is obtained, a feat practically impossible without the aid of a turnover machine.

The Use of Chills.

The use of chills is often condemned, and it must be admitted that the indiscriminate use of chills, whether external or internal, is to be deplored. Unfortunately, it is impossible to overcome contraction cavities in certain cases without their aid. Most founders are conversant with the type of casting where chilling in some form must be resorted to. In this respect the steel founder is often at the mercy of the designer. It is quite a common occurrence to be asked to produce castings having heavy bosses placed adjacent to a very thin section, and in

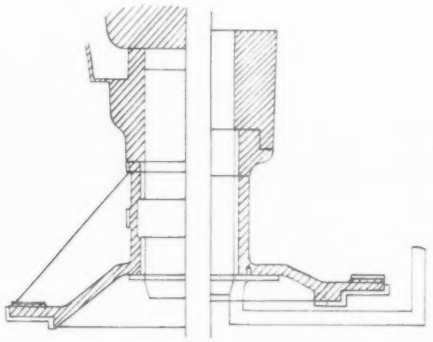

Fig. 6.—Section showing Method of Running Hub Castings.

such positions that it is utterly impossible to place feeder heads to ensure their soundness.

In the case of dry-sand work, the moulds are given an oil facing prior to stoving. This is

Fig. 7.—Hub Casting with the Flange Cast Uppermost.

necessary in order to produce a surface hardness, so that the mould is able to withstand the erosion of the steel. This oil facing produces a partially reducing atmosphere during the filling

Fig. 8.—Iron Wheel Centre.

of the mould. Whether this is beneficial or otherwise is open to question. Dr. Rosenhain dealt at some length with this particular subject in a Paper read at the Newcastle Convention

last year. Describing these oil facings as "flaming dressings," he states that these dressings are thought by several people to be advantageous, due to the fact that a more or less reducing

Fig. 9.—Rear Wheel Centre.

atmosphere is present in the mould during casting. Stating that a reducing atmosphere is thought to be desirable in so far as it prevents surface oxidation of the steel, Dr. Rosenhain is inclined to believe that this apparent advantage is more than outweighed by the disadvantages

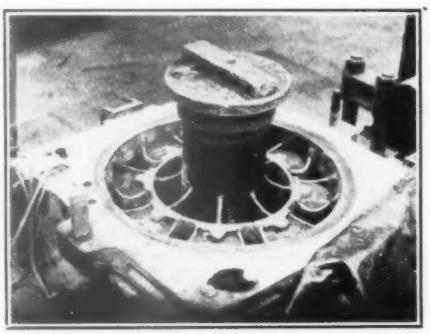

Fig. 10 shows the Bottom Half of the Rear Wheel on the Moulding Machine.

prevailing. Particularly does he point out the danger likely to be encountered of trapped gases, formed by the decomposition of the dressing, which continues for some time after the steel has come in contact with the mould.

The decomposition of the binder is taking place

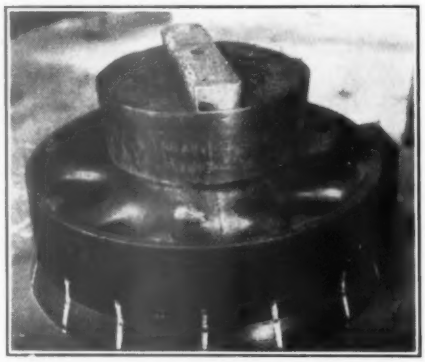

Fig. 11.—Top Half of the Rear Wheel Centre.

for some distance below the surface of the mould, and the generated gases have to escape somehow. Providing the mould is sufficiently permeable, this is successfully accomplished. If the amount of gas generated is so large that there is any hindrance to its passage through the interstices of the mould, there is a distinct possibility of gas being trapped in the casting. Whilst most will agree with what Dr. Rosenhain says, certain points require elucidation.

It is pretty widely thought that, as soon as steel comes into contact with the mould face, an "initial envelope" is formed. Is this "initial envelope" absent when using a flaming dressing or, in other words, is the reducing atmosphere which is set up sufficient to prevent a

Fig. 12.—Top Half of the Rear Centre Wheel Mould.

mould-surface oxidation of the steel for some time? Such seems to be the case; otherwise, how can one explain the presence of gases generated from an organic binder after the mould is filled. Another point worth consideration is, what is the alternative to using a flaming dressing? Being compelled to use a sand which yields easily, it is necessary, as stated previously, to reinforce the mould face, and, in the author's opinion, a mould treated with an oil facing is far less liable to cause trouble in the form of sand inclusions in the casting than a mould treated with a silica paint or any similar facing.

Sands.

As in all other branches of steel founding, sands, both facing and backing, play an important part. Careful attention must be paid to the permeability and strength, and what is perhaps more important still (especially in the case of green-sand moulding) the moisture content. Realising the need of a standard, the National Foundry Company have adopted the principle of drying both facing and backing sands before milling. The drying and milling of backing sand may appear to be superfluous,

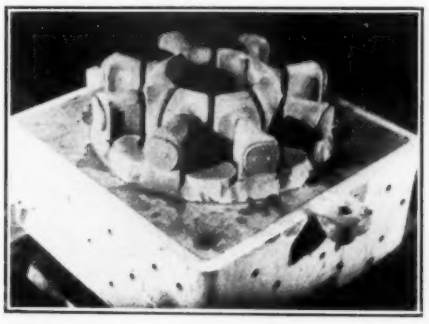

Fig. 13.—Bottom Half of the Rear Wheel Centre Mould.

but the extra expense involved in doing so is more than balanced by the results obtained. Being able to work the sand with a uniform moisture content of not more than 3 per cent., a very high permeability figure is attained.

Casting.

All moulds are poured by means of a stopper ladle. The method of bottom pouring has its detractors, but it is probably the best method to employ when dealing with castings such as have been described. As many as 90 to 100 different moulds are regularly cast in one heat. The fluidity of the steel is maintained for a considerable period when using a bottom pouring ladle, a very important factor indeed. To help to regulate the speed of entry into the moulds, different sizes of stoppers are used. The moulds are grouped, and for the smallest castings a $\frac{3}{8}$-in. dia. stopper is used. A 1-in. dia. stopper is used for castings weighing from $\frac{1}{2}$ cwt. to 1 cwt. Above that weight an $1\frac{1}{4}$-in. dia. stopper is preferred. Although the ladle man can exercise a fairly good control himself, it has been found that the policy of using various sizes of stoppers enables him to augment that control considerably. This is essential, as rate of pouring must go hand in hand with the down runner and inlet area. The main feature in favour of using a bottom pouring ladle is the absolute freedom from slag inclusions in the casting. However careful one may be when using lip-pouring ladles or shanks, it is almost impossible to prevent this trouble.

After being sand-blasted, all castings are examined, and, if approved, go through their respective stages in the dressing and annealing departments, subsequently passing on to the machine shop.

Notes from I.B.F. Branches.

Falkirk Section. — At a meeting held recently the following office bearers were elected for next session:—*Chairman*, Mr. Thomas Shanks; *Vice-Chairmen*, William Walker and Mr. John D. Smith; *Committee:* N. A. W. Erskine, Mr. T. B. Preston, Mr. J. N. Reid, Jr., Mr. G. C. Wilson, Mr. W. Phillips, Mr. Jas. MacIntosh, Mr. J. A. Donaldson, Mr. H. McNair and Mr. Thomas Haig. Mr. George B. Morrison, James Street, Stenhousemuir, Larbert, was re-elected local secretary.

East Midland Branch.—Recently the East Midlands Section of the Institute of British Foundrymen attended an interesting demonstration of melting at the Loughborough Technical College. The furnace used for the demonstration was one of the latest Morgan's Patent tilting crucible furnaces type "CA," of 200 lbs. brass capacity, fired by oil. The furnace was heated empty for 30 min. and then two charges, of 64/16 bronze and brass respectively, were melted from virgin metals. In each case the complete charge was melted in 30 min. with an oil consumption of 3.6 galls. per charge of 200 lbs. Considerable interest was taken in the latest features embodied in this furnace, and the fact that the metal was completely protected from the products of combustion received favourable comment. The furnace is in constant use in the routine work of the foundry and was demonstrated by kind permission of the College authorities.

Sheffield.—At the annual meeting of the Sheffield and District Section of the Institute of British Foundrymen, held at the Grand Hotel, Sheffield, Mr. W. T. Kitching was elected President in succession to Mr. C. D. Pollard.

Other elections were:—Mr. J. E. Hurst, Senior Vice-President; Mr. A. Whitely, Junior Vice-President; Mr. T. C. Firth, Dr. J. G. A. Skerl, Mr. A. E. Roebuck, Mr. J. B. Allan, Mr. S. Leetch, Mr. G. Offiler, Mr. J. Roxburgh, Mr. F. E. Steele and Prof. J. H. Andrew, Council; Mr. C. D. Pollard, Mr. J. E. Hurst and Dr. J. G. A. Skerl, representatives to General Council; Messrs. C. D. Pollard and T. R. Walker, representatives on the Technical Committee; Messrs. A. Whiteley and G. L. Oxley, auditors; Mr. T. R. Walker, hon. secretary and treasurer.

After the business meeting, Papers were given by Mr. J. R. Hyde (Stoke-on-Trent) and Mr. T. R. Walker (Sheffield) on "The Technical Committee and Technical Developments in connection with the Institute."

XUM

Institute of British Foundrymen.

ANNUAL CONFERENCE AT CARDIFF.

As previously announced, the Thirteenth Annual Conference of the Institute will be held at Cardiff from June 20 to June 23, 1933.

Since the Conference was last held in Cardiff twenty-one years ago, the Wales, Monmouth and West of England Branch has come into existence. The arrangements for the Conference are in the hands of the members of the Branch and their ladies, and they have given much thought to the preparation of a programme which they hope will enable the visitors to get the maximum amount of benefit from their stay in South Wales.

Visits have been arranged to a number of representative works, and an endeavour has been made to submit an enjoyable social programme. The day excursion on Friday, June 23, is of exceptional interest. The route passes through beautiful scenery, rich in historial associations, which include Tintern Abbey, Chepstow and the Roman remains at Caerleon. Cardiff itself is one of the most beautiful and attractive cities in Great Britain.

The railway companies have agreed to issue return tickets from any station in Great Britain (excepting the stations on Metropolitan and London Electric Railways) to Cardiff, at the ordinary single fare and one-third for the double journey (fraction of 3d. reckoned as 3d.). These tickets will be available from June 19 to June 24, 1933, and can be purchased at the booking office upon surrender at the time of booking of vouchers obtainable from the General Secretary.

Programme.

Tuesday, June 20.

General Council Meeting at the Park Hotel, Park Place. (Open to Members of the General Council only.) Time to be announced.

8.0 p.m.—Civic reception at the City Hall by the Right Honourable the Lord Mayor of Cardiff (Alderman C. F. Sanders, J.P.), and the Lady Mayoress (Miss Muriel Sanders).

Wednesday, June 21.

9.15 a.m.—Conference opens in the Lecture Theatre of the South Wales Institute of Engineers, Park Place. (Ladies invited.)

Civic welcome by the Right Honourable the Lord Mayor of Cardiff (Alderman C. F. Sanders, J.P.), supported by J. F. Rees, Esq., M.A., M.Com., Principal of the University College of South Wales and Monmouthshire.

Presentation of the Oliver Stubbs Medal.

9.30 a.m.—Annual General Meeting, open to all members, associate members and associates.

10.30 a.m.—Presidential Address, Mr. C. E. Williams.

10.50 a.m.—Presentation and discussion of Papers Nos. 520 and 521.

12.30 p.m.—Conference adjourns.

12.45 p.m.—Luncheon at Messrs. David Morgan's, Limited, The Hayes, Cardiff.

2.0 p.m.—Coaches leave Messrs. D. Morgan's, Limited, for works visits. (As each visit will occupy the full afternoon, members may join *one* party only.)

(1) The British (Guest Keen Baldwin) Iron & Steel Company, Limited, Cardiff Blast Furnaces, and Messrs. John Williams & Sons (Cardiff), Limited, Cardiff. (This is a combined visit of the two works, and will afford an opportunity of a view of the Cardiff Docks.)

(2) Messrs. Brown Lenox & Company, Limited, Pontypridd (steel foundry and manufacturers of chains).

(3) Messrs. Powell Duffryn Steam Coal Company, Limited, Ystrad Mynach (steel, iron and brass foundries).

7.0 p.m.—Annual banquet, followed by dancing until 1 a.m. at the Park Hotel, Park Place.

Thursday, June 22.

9.30 a.m.—Conference continues in the Lecture Theatre of the South Wales Institute of Engineers, Park Place. The following Papers will be presented and discussed: Session A. Nos. 522, 523 and 524; Session B. Nos. 525 and 526.

12.30 p.m.—Conference adjourns.

12.45 p.m.—Depart for Bristol. Members and ladies entrain at Queen Street Station (near Conference Hall). Luncheon will be served on the train. (This train will not pick up passengers at the General Station; all must join the train at Queen Street.) On arrival at Stapleton Road Station, Bristol, motor coaches will meet the delegates and convey them on the following visits:—

(4) The tobacco works of Messrs. W. D. & H. O. Wills, Limited, and

(5) The Bristol Aerodrome.

Time will only permit of *one* visit. The entire party will return to Cardiff by special train from Stapleton Road Station, Bristol.

8.0 p.m.—Reception at the University, by kind invitation of the Principal of the University College of South Wales and Monmouthshire, concluding from 10 to 10.30 p.m.

Friday, June 23.

9.30 a.m.—Motor coaches leave the South Wales Institute of Engineers, Park Place, for tour through some of the most beautiful scenery of Glamorgan, Monmouthshire and Gloucestershire, by way of Newport, Caerleon (visit to ruins of Roman Amphitheatre), Usk, the Wye Valley, Tintern Abbey. Halt at Tintern to inspect the ruins, continue to Sedbury Park, and return via Newport and Cardiff. This tour gives magnificent views of the Wye and Severn Valleys and the surrounding country. Suitable arrangements are being made for lunch and tea during the tour.

Ladies' Programme.

Tuesday June 20.

8.0 p.m.—Reception by the Right Honourable the Lord Mayor of Cardiff (Alderman C. F. Sanders, J.P.), and the Lady Mayoress, at the City Hall.

Wednesday, June 21.

9.15 a.m.—Ladies are invited to the opening of the Conference.

9.45 p.m.—Ladies will meet outside the South Wales Institute of Engineers, Park Place, and visit Cardiff Castle, by kind permission of the Most Honourable the Marquis of Bute.

12.45 p.m.—Luncheon at Messrs. David Morgan's, Limited, The Hayes. (See general programme.)

2.0 p.m.—Coaches will leave Messrs. David Morgan's, Limited, for a tour in the neighbourhood of Cardiff, calling at the residence of the President, Mr. C. E. Williams, and Mrs. Williams, for tea.

7.0 p.m.—Annual banquet and dancing. (See general programme.)

Thursday, June 22.

9.30 a.m.—Assemble at the South Wales Institute of Engineers, Park Place, and proceed to the Welsh National Museum, and afterwards free to inspect the shopping centre.

12.45 p.m.—Join the delegates at Queen Street Station, and entrain for Bristol. Luncheon will be served on the train. At Stapleton Road Station, Bristol, the train will be met by motor coaches, which will convey parties to Messrs. Fry's chocolate factory. Return to Cardiff by special train from Stapleton Road Station.

8.0 p.m.—Reception by kind invitation of the Principal of the University College of South Wales and Monmouthshire. (See general programme.)

Friday, June 23.

9.30 a.m.—Motor-coach excursion to the Wye Valley, etc. (See general programme.)

Newcastle Foundrymen Elect New Officers.

The Annual General Meeting of the Newcastle Branch was held in the Neville Hall, Newcastle-upon-Tyne, on April 27, 1933, Mr. W. Scott, Branch-President, being in the chair.

On the proposal of the Chairman, the annual report was taken as read and formally adopted. The election of officers for the 1933-34 session then took place, with the following results:—*Branch President*, Mr. J. D. Carmichael, O.B.E.; *Senior Vice-President*, Mr. F. Robson; *Junior Vice-President*, Mr. S. E. Dawson; *Hon. Secretary*, Mr. J. W. Eckford; *Hon. Treasurer*, Mr. J. N. Simm.

Mr. Goodfellow was elected to the Branch Council, and Messrs. W. Scott and J. N. Simm were re-elected as representatives to the General Council. Mr. Logan and Mr. S. E. Dawson were elected as the Branch representatives on the Technical Committee.

On behalf of the Council and members of the Branch, Mr. Scott proposed a vote of thanks to Mr. Eckford and Mr. Simm for the work which they had done during the past year. Mr. Scott then called upon Mr. Frier, the chairman of the John Surtees Memorial Committee, to present the prizes to the successful competitors.

Presentation of Prizes.

Mr. Frier said that, unfortunately, the number of entrants had been considerably reduced, the number being eight this year as against 50 last, although the standard attained was higher than at any previous examination. They had tried a new scheme of having a practical examination on the practical side; in previous years questions had merely been asked concerning the practical side. The work had been exceptionally well done, and it had been difficult to apportion the marks in the practical work. However, the technical side of the examination, which had been conducted by Mr. Carmichael, had settled the matter. He would like to remind the boys who had attended that year that there was a gold medal they could win. It had never been won by the Newcastle Branch, and he would like to see some of them try to win it.

The prize-winners were (1) Mr. T. White and (2) Mr. H. Vasey. Mr. Frier appealed to all members who had boys under them to encourage them as much as they possibly could. He knew that there used to be a tendency to put a boy on one job and keep him at it, but that was not the way to encourage him. Vary his jobs and give him a chance to find things out for himself.

Mr. Scott congratulated the boys on their performance. His next duty was a pleasing one—the presentation of prizes for the Papers entered in the competition which had been held that session. Mr. Vasey was the winner of the Junior Section, as well as the second prize-winner of the John Surtees Memorial Competition. Mr. Elson was the winner of the Senior Competition.

After the reading of his Paper, Mr. Vasey was thanked by Mr. Scott on behalf of the meeting. Mr. Scott said that he did not propose to open the Paper for discussion, but he was going to offer Mr. Vasey their thanks for his Paper, and he hoped that it would spur on the younger section to greater efforts. Mr. Scott also informed the meeting that at the Council Meeting which had just been held they had been discussing the poor year they had had. There had been small attendances at the lectures, and a lack of enthusiasm among the members, which, of course, was all due to local trading conditions. They had discussed certain alterations in the procedure to try to help matters next session. He appealed to all of them to do their best to make the next session more successful.

A vote of thanks to Mr. Scott was accorded by the meeting, on the proposal of Mr. Paulin.

The Foundry Trades' Equipment and Supplies Association, Limited.

ANNUAL MEETING.

The Annual General Meeting of the Foundry Trades' Equipment & Supplies Association, Limited, was held on the last day of the Foundry Exhibition at the Royal Agricultural Hall, Mr. D. H. Wood presiding. After the notice convening the meeting had been read, the following report was submitted:—

Annual Report.

In common with many other trade organisations and most commercial undertakings, the Association has suffered some loss during the year 1932, and the number of members as at December 31 stands at 30, as compared with 35 at the corresponding date last year. This position has been brought about owing to the resignation of five members, the going out of business of one more, and, on the other hand, the recruitment of one new member. It is possible that one or two of these losses may be made good in the Exhibition year, and that that event will bring some new applications for membership, but it is obvious that in these circumstances it is more than ever necessary for members to exert every possible influence on their friends engaged in the industry who are suitable for membership to apply to join, so that our work may continue and in particular to the end that we may be self-supporting financially from year to year, quite independently of any occasional swelling of our resources from Exhibition revenue.

So far as the accounts themselves are concerned, it is gratifying to note that they showed for this year an excess of income over expenditure as against the reverse position in the previous year. This is entirely accounted for by the fact that we did not this year produce an Association Handbook, which has never been self-supporting but has involved a slight drain on the Association's resources. It is with the very greatest regret that we have to embody in this report a record of the sudden and untimely death of our late Vice-President, Mr. H. G. Sommerfield. As member, councillor and probable President-Elect he rendered most loyal and valuable services to our work, and we are much the poorer for his loss. After a resignation from the Council and a change of business activities, our Past-President, Mr. A. S. Beech, is once again, we are glad to say, amongst us on the Council, and we hope that we may long have the benefit of his co-operation and advice.

The main concern of our Association during the current year has been with the coming International Foundry Trades' Exhibition. This Exhibition differs from its predecessors as organised by this Association in one or two particulars, and, of course, labours under the prevailing difficult trade conditions. It will be extremely interesting, however, to observe how much such an event at a time like this can prove a stimulus to our industry. There is on this occasion no International Congress as in 1929, which, in fact, will not be due to be held again in England for many years, and, moreover, the Exhibition is not being held at the same time or place this year as the Annual Convention of the Institute of British Foundrymen. Whilst there are undoubtedly certain advantages of linking up the Exhibition with the Convention, it is not by any means certain that these are not outweighed by certain inevitable disadvantages. Foundrymen attending their Convention have their time very fully occupied, and it is quite possible that they do not succeed in putting in as much time as they or the exhibitors would like at the Exhibition proper. On the present occasion the heartiest welcome is being extended to members of the Institute of British Foundrymen and all other foundrymen who attend the Exhibition, and a special day for the Institute has been arranged when all their members will be entertained at the Exhibition by the management. It is felt that by this method the greatest concentration can be made on the exhibits themselves. In addition, invitations are also being extended to members of the British Cast Iron Research Association, the British Ironfounders' Association, and the National Ironfounding Employers' Federation, and these will all be entertained on another day during the Exhibition. This Exhibition will not see the inclusion of a Section of imported machine tools, as in 1929, and, in fact, the tariff and currency situations make it exceedingly difficult for a large foreign representation to be staged. On the other hand, attention will be all the more intensely focused on exhibits from this country, and the Exhibition should prove a great encouragement to those now making here commodities previously imported. The technical non-commercial exhibits are being treated somewhat differently on this occasion, and are divided into two separate stands, which are entrusted respectively to the Technical Committee of the Institute of British Foundrymen and to the British Cast Iron Research Association. The former body are making a feature of special-duty castings replacing drop stampings and forgings, etc.

Mr. R. H. Brackenbury.

(Newly-Elected President of The Foundry Trades' Equipment and Supplies Association, Limited).

Attempts to co-ordinate exhibition policy in the main Continental countries have met with very great difficulty, and it has not been found practicable to make much progress. Those international exhibitors who show in most countries, and who are articulate on the subject, not unnaturally wish to limit the number of Exhibitions, and it has been found that, were this policy pursued, it would not be possible to hold a representative exhibition in England more often than perhaps once in twelve years. Moreover, there do not appear to exist any organisations in the principal European countries parallel with our own in the capacity of exhibition control, and it has been felt that it must be left to time to evolve some solution to this problem. In the meantime trading conditions between this country and the Continent do not become any easier, and it was not found possible to organise any substantial form of British representation at the last International Foundry Exhibition, held in Paris in September, 1932.

The practice of making a collective subscription to the funds of the Annual Convention of the Institute of British Foundrymen was continued, and it seems quite possible may be so in the future, as this is found to be of considerable benefit to all members.

The Council has devoted considerable attention to suggestions which are made for some slight reorganisation of the administrative work of this Association. It has been submitted that greater efforts must be made to interest the general body of members outside those represented on the Council. It will be remembered that a recent innovation was the issue of the monthly *précis* of Council business to all members, and following upon this the practice has been instituted of asking all members to meet at luncheon at the Northumberland Rooms, Northumberland Avenue, London, W.C.2, on the days of Council meetings, when various subjects of general interest could be discussed and perhaps the Council could receive some guidance for their subsequent deliberations. We might mention that the attendance at these lunch meetings has not been very large. It may be found desirable to go some stages further and to call more general meetings of the Association in the course of the year for the conduct of all matters of policy, leaving to a small Executive questions of finance and routine. This, however, must all be arranged within the framework of the constitution as laid down in the Memorandum and Articles of Association, and ample opportunity will be provided for a discussion on this subject at the next annual general meeting.

Finally, the Council would wish once again to express their thanks to the Proprietors of The Foundry Trade Journal, our official organ, for the assistance rendered to us from time to time, and particularly for such publicity as they are able to give to our major enterprises, such as the International Foundry Trades' Exhibition.

The report is signed by Mr. D. H. Wood, the President, and Mr. K. W. Bridges, the honorary secretary.

Election of Officers.

The retiring councillors were re-elected, together with Mr. D. C. Paterson, of Messrs. Paterson - Hughes Engineering Company, Limited, of Glasgow.

At a meeting of the Council which followed, Mr. R. H. Brackenbury, of Sterling Foundry Specialties, Limited, of Bedford, and Victoria Street, London, was elected President, and Mr. G. T. Lunt, of Bradley & Foster, Limited, Darlaston, with Mr. A. C. Turner, of the London office of General Refractories, Limited, Sheffield, Vice-Presidents.

Steel Consumption.—Addressing the members of the Tees-side Chamber of Commerce recently, Sir Peter Rylands said the consumption of steel during the past forty years had risen until the normal consumption to-day was at least 100,000,000 tons a year. Judging from past experience, he said, this would increase in another twenty or thirty years to 140,000,000 tons. Mr. Arthur Dorman said that Middlesbrough was rather despondent about the iron and steel trade, but he thought there were indications of a slight improvement. Dorman, Long & Company, Limited, had booked the Copenhagen bridge contract, and he thought they had also secured the contract for the Fulham Power Station. The contracts would involve a total of about 50,000 tons of steel, and, he hoped, would enable the works to produce with greater regularity.

Welding Ferrous and Non-Ferrous Metals.

A lecture was given before the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen, on March 23, by Mr. W. C. Freeman, the hon. secretary of the Midland Section of the Institute of Welding Engineers on "The Welding of Ferrous and Non-ferrous Metals."

In his opening remarks the President, Mr. J. G. Pearce, M.Sc., referred to the welding industry, and said that the opinion was sometimes expressed that this industry was killing the foundry industry. He did not agree with that view at all; he thought there would always be a place for both, and he was of the opinion that each should endeavour to assist the other, and so obtain probably better results to their mutual advantage.

Mr. Freeman opened his lecture by explaining the manufacture of calcium carbide and the production from it of acetylene, proceeding to describe the chemical actions which took place, the manner in which the oxygen was introduced in order to obtain the oxy-acetylene flame. He described the types of burner in general use, and the advantages to be derived from them for various purposes. He then passed to a short discussion on the methods of welding copper, aluminium and cast iron, enumerating the methods of working for each class of metal, the dangers to be encountered and the provisions to be adopted to overcome them, showing illustrations of work done in each of the three types of metal. Finally, he referred to the oxy-acetylene blow-pipe used for cutting metal, and explained its general design and principles, stating some of the many uses to which it was put.

A Potential Competition.

Mr. C. H. Plant, proposing a vote of thanks, said that he had attended all the meetings of the Local Section of the Institute of Welding Engineers since its inception at the end of the year 1931, and he had been astounded to learn to what an immense variety of structures welding could now be applied. He agreed with Mr. Pearce's opening remarks, but had nevertheless often thought that the foundry industry did appear to be in some degree of danger. Referring to some of Mr. Freeman's remarks regarding the welding of cast iron, and especially of malleable cast iron, he agreed that it was very difficult to weld the latter metal, but he had recently had brought to his notice a large-scale beam, which was cracked, and which was successfully welded by means of copper welded into the malleable cast iron. It was probable, however, that this was more of a brazing job than a true weld.

Referring to Mr. Freeman's remarks about pre-heating, he would like to know if the twin blow-pipes shown so much on the film which had recently been exhibited under the auspices of the Institute of Welding Engineers, had the same effect as pre-heating, and if the twin blow-pipe did away with the necessity of pre-heating the metal as described by Mr. Freeman.

Mr. Pearce said he was not quite clear as to when a filling rod was used and when it was not. Was autogenous welding the method of welding without the use of a filling rod?

Mr. Freeman, in reply, said Mr. Pearce's suggestion with regard to autogenous welding was not correct. Autogenous welding was to bring the edges of the metal together by fusion with or without a filling rod. An example was in sheet-metal work, where a very fine joint was required. The edges of the metal were just fused, put together and hammered down.

Welding and Skilled Operators.

A Member, referring to the welding of copper and aluminium, said he had seen attempts to weld these metals for many years, and was of the opinion that the advances which had been made were due to the materials with which the welder could now be supplied. In the welding of some large vessels he had used a gas flame, and on the side opposite to the welder he had had a gas flame impinging. He had formed the opinion that the factor which governed the success of any welding operation was the skill of the operator. He was interested in the welding of malleable cast iron, and would also like to know something of the welding of stainless steel. He had had some experience of castings in special iron which had to stand a very high air pressure, and in cases where they had leaked the faulty part had been cut away and the vessel welded very successfully.

Mr. Freeman said he was in agreement with all the last speaker had said. With regard to the malleable casting, they all knew what that was, and if they put into a malleable casting a rod which melted at 800 deg. C. there would be a chance of preserving the malleability, but it would be destroyed by the use of a high-silicon rod. He could agree with the use of the coal-gas flame for copper welding. With regard to stainless steel, this had come very much to the front lately, and, providing one knew the composition of the steel, there would be no difficulty. There was no limit to the range of metals the welding of which presented no difficulty. It would be advisable to refer to the manufacturers for a specification of the rods which would conform to the specification of the metal, and after the welding of a steel structure it was better to have it annealed.

Weldable Cast Iron.

Mr. Pearce said they all knew the difficulties of welding cast iron, and he would draw attention to the developments of two new cast irons which were much more easily weldable. These cast irons were in the austenitic condition. One of them was termed Niresist and contained nickel and copper, and the other was known as Nicrosilal, containing nickel, chromium and silicon. They were very useful for parts which had to be welded. They did not scale at ordinary welding temperatures, they had a measure of ductility and the amount of graphite and combined carbon was relatively small. Tests had shown that a welded bar was equally as strong as in its original condition. They could be used to weld ordinary grey irons.

Recent Advances in the Field of Silumin Castings.

Mr. G. Sachs, the head of the Metallgesellschaft metallurgical laboratory in an article in the "Metallgesellschaft Periodic Review," March, 1933, first deals generally with the development of the 13 per cent. silicon alloy, modified originally with metallic sodium and recently, to eliminate pinholing, with both metallic sodium and salts. The excellent casting properties and freedom from "hot-shortness" of silumin are mentioned, and also its suitability for chill casting and the satisfactory results attained by the extensive use of iron chills when sand casting. The alloy is also widely used for (pressure) die casting, and in this case it is advisable to use machines causing the minimum absorption of iron, though the latter's deleterious effect may be to some extent overcome by the addition of manganese.

The normal silumin alloy is distinguished by its resistance to corrosion, high elongation and comparatively good tensile strength, its properties making it appropriate for chemical plant and certain structural purposes. A shortcoming, however, is its low-fatigue strength, and research to improve it led to the development of copper-Silumin containing 0.8 per cent. of copper, to which alloy the field of internal-combustion engine castings was opened up. Later an addition of about 0.3 per cent. of manganese was made; this slightly increased the hardness of the alloy and is useful in counteracting the influence of excess iron (or copper), which would impair the mechanical properties and corrosion resistance. Cobalt and chromium have the same effect as manganese.

A new heat-treated silumin alloy was placed on the market last year, marked by high-fatigue strength and by the fact that even thin castings are not liable to cracking or warping due to the abrupt temperature changes during heat-treatment. This alloy is named silumin-gamma, and contains 12 per cent. silicon, up to 0.5 per cent. magnesium according to the degree of hardness required, and between 0.3 and 0.5 per cent. manganese. In the untreated condition it is known as silumin-beta and has mechanical properties comparable with those of copper-silumin together with better corrosion resistance. The mechanical properties can be raised simply by tempering and are further improved by full heat-treatment, as shown in the table, in which the two conditions are referred to respectively as "tempered" and "age-hardened." Still higher properties are obtainable by means of a special, more complicated heat-treatment. Silumin-gamma is also stated to have good properties in the (pressure) die-cast form, tensile strengths up to 25 tons/sq. in. and hardness up to 140 Brinell having been attained.

The text of this article is illustrated with photomicrographs of alloy structures, and photographs of various applications. The following valuable Table (Table I) is also given.

Table I.—*Properties of the new Silumin Alloys.*

Alloy and specification.	Casting method.	Yield point. σ SO,2. Tons per sq. in.	Tensile strength, σ B. Tons per sq. in.	Elongation. δ 10. Per cent.	Hardness H10/500/30. Tons per sq. in.	Fatigue bending strength. σ W. Tons per sq. in. (Basis, 20 Mill.).
Silumin	Sand	5.5—6	11—13	4—8	55—60	4.5
13 per cent. Si	Chill	8—8.5	15—16	3—5	70—75	8
Copper-Silumin	Sand	6—6.5	11—13	2—4	60—65	5.5
12 per cent. Si, 0.8 per cent. Cu, 0.3 per cent. Mn	Chill	8.5—9	15—16	2—3	75—85	9
Silumin Beta (as-cast)	Sand	6—7	11—13	2—5	55—65	6.5
12 per cent. Si, 0.3 per cent. Mg, 0.45 per cent. Mn	Chill	8.5—9.5	15—16	2—3	75—85	10
Silumin Gamma*	Sand	7—10	13—14	4—1	65—75	6.5
Tempered (150 deg., 20 hrs.)	Chill	10—14	16—18	3—1	80—95	10
Silumin Gamma*	Sand	11.5—16	16—18.5	4—0.5	80—100	8.5
Age-hardened (510 deg. C., 3 hrs.; 150 deg. C., 20 hrs.)	Chill	13—18	17—20.5	1.5—0.5	85—110	11

* Same specification as Silumin Beta.

This Week's News in Brief.

Trade Talk.

The Hammond Lane Foundry Company, Limited, of Pearse Street, Dublin, one of the largest foundries in the Irish Free State, at their first annual dance had over 250 guests present.

Messrs. Sir William Arrol & Company, Limited, Bridgeton, Glasgow, have secured the contract for the pipe line at Glenlee in connection with the power works of the Galloway Power Company.

Messrs. Gruer & Company, Limited, Clynder, have secured an order to build a fast cruising type of sailing yacht with Bermudian rig for the Sultan of Zanzibar. The yacht will be 37½ ft. long and is to be shipped abroad on June 15.

A steel wire rope 10,800 yds. in length by 2¾ in. in circumference, made in one continuous length and weighing approximately 20 tons, has been manufactured by British Wire Ropes, Limited, at their Excelsior Works, Cardiff, for use as an aerial haulage rope in the Midlands.

Under the Anglo-German Trade Agreement, wrought enamelled hollow-ware of iron and steel, of a description commonly used for domestic purposes, will be subject to a duty on importation into the United Kingdom from Germany of 20 per cent. against 25 per cent. at present.

Messrs. Swan, Hunter & Wigham Richardson, Limited, the Wallsend shipbuilders, announced recently that their shipyard at Sunderland, which has been without work for some time, is to be permanently closed and sold to National Shipbuilders' Security, Limited, for scrapping.

Manchester City Council recently accepted a recommendation of the Corporation Electricity Committee giving contracts for static transformers to the Metropolitan-Vickers Electrical Company, Limited, of Trafford Park, and to Ferranti, Limited, of Hollinwood, at a total cost of £16,149.

The official opening of the bowling greens and tennis courts at Shotts Ironworks took place on May 3, in the presence of a large number of employees and friends. Mrs. J. Stewart threw the first jack on the green, and Mrs. J. McKnight played the first service on the courts.

The former German battle cruiser, "Prinz Regent Luipold," one of the German fleet scuttled at Scapa Flow, has been brought to Rosyth to be broken up. On her arrival at Rosyth she was opened to the public for inspection and the proceeds therefrom will go to local hospitals.

Soviet Russia has this year purchased seven vessels of 1,600 to 5,750 tons each from British shipowners, chiefly for the timber-carrying trade. The purchases have been made on the basis of long-term credits up to 33 months, and no immediate payments were made in the transactions.

Mr. Arthur Leggett, in conjunction with Mr. L. Turner, Mr. F. W. Turner, and others, has purchased from Agricultural & General Engineers, Limited (in liquidation) the whole of the A.G.E. share holding in Messrs. E. R. & F. Turner, Limited, and Bull Motors, Limited, of Ipswich. Mr. Leggett is now chairman and managing director.

Messrs. Alexander Anderson & Sons, Limited, Carfin, Lanarkshire, have obtained a large order for marine boilers for China which will keep 100 men steadily employed for some months. The boilers are to be despatched complete with forced-draft and pre-heater equipment. All the material required for the construction of the boilers will be rolled in Motherwell steelworks.

The new steamer "Harbledown," the sixth vessel built by Messrs. Lithgows, Limited, Port Glasgow, for Messrs. J. & C. Harrison, Limited, London, completed her trials successfully on the Firth of Clyde. She is 440 ft. in length, with a deadweight carrying capacity of 9,800 tons. The propelling machinery was supplied by Messrs. David Rowan & Company, Limited, Glasgow.

The ascertainment for the three months ending March, 1933, for the purpose of the North of England steel melters' sliding-wage scale, shows an average net selling price of £8 0s. 0.68d. per ton. This means that there will be an increase of 7½ per cent. in the sliding-scale percentage to operate for the three months commencing May 7, 1933, the basic scale being at 27½ per cent. and the acid scale at 2½ per cent. above base.

The Incandescent Heat Company, Limited, are making extensive additions to their works in Cornwall Road, Smethwick. For a considerable time increasing demands upon the works have been met by the installation of additional plant, such plant having, of course, to be put down where space was available. The scheme of extension provides for the rearrangement of a considerable portion of the existing works, which will not only enable the throughput to be speeded up, but will be more economical in operation.

The closing of the Vulcan Tube Works at Motherwell, belonging to Messrs. Stewarts & Lloyds, Limited, has been announced. All of the staff and workers have received notice to terminate their engagements on May 31. The largest tubes made by the firm were produced at the Vulcan Works, and during the past 15 years many important orders have been executed for home and foreign markets. It is hoped, in view of the chairman's remarks at the recent meeting in Glasgow, that the work may be transferred to Coatbridge.

Last week a part cargo of 300 tons of pig-iron from Calcutta was unloaded from one of the City Line steamers at Prince's Dock, Glasgow. About 1,000 tons of chrome ore from Beira and 600 tons of steel from the Continent were also landed at Glasgow Harbour. Shipments of steel products totalled 2,000 tons, which were despatched to China, South Africa, India, Japan, British Columbia, France, Canada, Chile, New Zealand, Peru, and England and Ireland. At Bowling 450 tons of pig-iron from Millom were discharged.

A resolution, protesting against the failure of the National Committee of the Iron and Steel Industry to provide compensation for displaced workers during reorganisation, has been passed by delegates representing the industry of the North-East Coast and Workington and Barrow districts. No scheme of reconstruction, states the resolution, which makes provision for compensation to employers in the case of redundant plants and no provision for the workers thus displaced, can be accepted as satisfactory by the workers engaged in the industry.

The Trade Marks Committee, which was set up in January last under the chairmanship of the Rt. Hon. Viscount Goschen, to consider and report whether any, and if so what, changes in the existing law and practice relating to trade marks are desirable, are continuing their meetings for the purpose of hearing evidence from interested persons and associations. Seven meetings of the Committee have taken place, and during the next few weeks evidence will be taken from representatives of the Trade Marks, Patents and Designs Federation, Limited, the Trade Mark Owners' Association, Limited, and the Chartered Institute of Patent Agents. Any persons or associations who desire to submit any further suggestions, or to give evidence, should notify their intention to the secretary to the Committee, Mr. R. W. Luce, Industrial Property Department, Board of Trade, 25, Southampton Buildings, W.C.2, not later than June 3 next.

About 50 members of the Edinburgh, Leith and District Master Plumbers' Association visited Carron Ironworks last week. The visitors, who were welcomed on arrival by Mr. George Pate, O.B.E., manager of the Carron Company, proceeded to the Mungal Foundry, where they were afforded an opportunity of witnessing the various processes in the production of castings in which they are particularly interested. Later they visited the Low Foundry, where they saw the manufacture of baths from moulding to enamelling and finishing. The party evinced a keen interest in the work of the various departments producing such goods as are regularly handled by plumbers. At the conclusion of the visit Mr. Henry Drummond, President of the Association, expressed thanks to the company for their attention and hospitality.

Company Reports.

Park Gate Iron & Steel Company, Limited.—Dividend of 1 per cent., less tax, for the year ended March 31, 1933.

Glenfield & Kennedy, Limited.—Final dividend on the ordinary shares of 2 per cent., making 4 per cent., less tax, for the year.

Union Steel Corporation (of South Africa), Limited.—Profit for 1932, £29,265; brought in, £22,208; dividends on the "A" and "B" preference shares for 1930 and 1931, £18,519; carried forward, £32,954.

Personal.

Mr. Bertram E. Stott, A.M.S.T., who for 19 years was associated with the Harland Engineering Company, Limited, of Alloa, has been appointed general manager of Ferrous Light Castings, Limited, ironfounders, of Stafford Road, Warrington.

Mr. Arthur G. Brown has been appointed by the Whitehead Iron & Steel Company, Limited, as manager of the finishing mills at Scunthorpe, Lincolnshire, which are being erected by the company in conjunction with Messrs. Richard Thomas & Company, Limited.

Mr. Alan Chorlton, M.P., President of the Institution of Mechanical Engineers, has been appointed by the Prime Minister to represent His Majesty's Government at the World Power Conference to be held in June and July next at Copenhagen, Stockholm and Oslo.

Dr. M. L. Kahn has been appointed by the General Electric Company, Limited, to the position of chief engineer of the engineering department at their Witton Works, thereby taking over the duties hitherto performed by the late Mr. R. Orsettich. Dr. Kahn has been chief of the design department at Witton for the past 20 years.

Mr. J. Iball, who is retiring from the position of chief clerk in the pig-iron department of the Staveley Coal & Iron Company, Limited, was last week presented by Mr. H. H. Berresford, commercial manager, with a cheque representing subscriptions from members of the staff. Mr. Iball has been in the service of the company for 37 years.

Miss M. D. Pittuck, who two years ago was chairman of the Junior Section of the London Branch of the Institute of British Foundrymen, is to be married on May 27 to Mr. Stanley Hutchcroft Williams, only son of Mr. F. W. Williams, managing director of John Feaver, Limited, iron and tinware manufacturers, of Tower Bridge Road, London, S.E.1.

Mr. Richard Hodgson, governing director of Allan Haigh & Company, Limited, brassfounders, of Winding Road, Halifax, is the newly-appointed captain of the West End Golf Club, Halifax. Prior to joining his firm in 1902, he was with H. A. Hodgson & Company, ironfounders, of Cleckheaton. He has been a member of the Court of Referees of the Halifax Employment Exchange, as an engineering trade representative, ever since the Court's inception.

Mr. Robert Morton, traffic manager at Messrs. Colvilles, Limited, Dalzell Iron and Steel Works, has on his retirement after 34 years' service been made the recipient of a wireless set, together with a handbag and umbrella for Mrs. Morton. The presentation was made by Mr. S. Thompson, mill manager, who referred to Mr. Morton's long and faithful service to the firm, and expressed the hope that he might long be spared to enjoy his retirement.

Mr. John Polson, commercial manager of the steel department of Messrs. Stewarts & Lloyds, Limited, has retired, and was entertained at dinner in the Central Station Hotel, Glasgow, on May 2 by members of the Scottish Steel Makers' Association. Mr. John Craig, managing director and chairman of Messrs. Colvilles, Limited, presided, and referred to the services which Mr. Polson had rendered to the Scottish steel trade and to the Association during his 36 years' membership of it. The chairman presented to Mr. Polson a silver salver as a mark of regard and goodwill.

Wills.

Harris, H. E., managing director of the Bowesfield Steel Company, Limited, Stockton £13,979

Reid, Sir John, of Glasgow, a director of the North British Locomotive Company, Limited £336,572

Obituary.

Mr. Albert Edward Dunstan, ferro-alloy merchant, of 459, Queen's Road, Sheffield, died recently.

Mr. William M'Laren, a partner in the firm of Thomas M'Laren & Sons, Victoria Foundry, Galashiels, died on Saturday, April 29, aged 65.

The death occurred very suddenly on May 3 of Mr. Patrick J. M'Kenna, senior roller in Messrs. Colvilles, Limited, Dalzell Steelworks, Motherwell. Mr. M'Kenna, who was 64 years of age, had been in the employ of Messrs. Colvilles for many years.

XUM

Raw Material Markets.

There has continued to be a steady demand for pig-iron in the home markets, but hand-to-mouth buying still predominates. Finished steel is also in slightly better call, the improvement largely resulting from the shipbuilding orders recently placed.

Week-end reports indicated that the re-establishment of the Continental Steel Cartel has now been virtually completed. Agreements regarding the setting-up of selling offices were signed by the participating countries last Friday. Sentiment in the steel market has been considerably strengthened, more especially so as it is expected that the official prices, yet to be announced, will show a considerable increase on current quotations.

Pig-Iron.

MIDDLESBROUGH.—The local merchant trade in pig-iron is not very active at the moment, but fortunately there has been an increase in the amount of iron going into consumption at the steelworks, where prospects are considerably brighter. Export business is still exceptionally difficult to secure, and very low quotations are being made in this connection. Prices for home-trade business are unaltered. In the case of the standard No. 3 Cleveland G.M.B. foundry grade, the minimum rates are 62s. 6d. per ton delivered Middlesbrough area, 62s. 9d. delivered Glasgow, and 64s. 6d. delivered North-East Coast. There is a premium of 2s. 6d. for No. 1 foundry grade, No. 4 foundry and No. 4 forge iron being each 1s. per ton less than No. 3.

Heavy sales of East Coast hematite have recently been made to South Wales, while the usual trade is being done with steelworks in Sheffield and the Midlands. In spite of this, the output of iron is not being fully absorbed, and additions have been made to stock. It is reported, however, that a local furnace formerly making hematite has been put on to ferro-silicon. The market quotations remain at 59s. for mixed numbers and 59s. 6d. for No. 1 quality, f.o.t. or f.o.b. It has become difficult to maintain these figures however, and consumers claim to have bought at slightly lower levels.

LANCASHIRE.—Deliveries into consumption are maintained at about recent levels. The light-castings and speciality foundries are fairly well engaged, but few of the jobbing foundries have anything approaching satisfactory order-books. Conditions in the textile-machinery trade are still sluggish. A few three-months contracts for pig-iron have recently been arranged, but month-to-month purchases are general. The basis for delivery to users in the Manchester district remains as before, namely, 67s. per ton for Derbyshire and Staffordshire brands of No. 3, with Northamptonshire at 65s. 6d. and Derbyshire forge at 62s. North-East Coast makes, also for delivery in the Manchester area, are more or less nominal at 67s. per ton, with Scottish foundry iron at around 82s.. East Coast hematite at 75s. 6d. and West Coast at 80s. 6d.

MIDLANDS.—Pig-iron prices have recently been re-affirmed by the makers at 62s. 6d. per ton for Northants No. 3 and 66s. for North Staffordshire, Derbyshire and Lincolnshire No. 3, including delivery to Birmingham and Black Country stations. Any forge iron for the use of foundries is 4s. under the No. 3 level. Current business is largely confined to small sales for immediate delivery, the majority of consumers being covered by running contracts. Better activity is being witnessed in the light-castings industry. With regard to special pig-irons for foundry use, Scottish No. 3 is unaltered at round about 83s. to 85s. per ton delivered this district, but other medium-phosphorus irons are available at down to 70s. In the hematite market there is a controlled price of 84s. 6d. for West Coast hematite; Welsh and East Coast iron, upon which no restrictions are placed, is quoted at 74s. to 77s. 6d.

SCOTLAND.—The general demand for pig-iron remains limited. One or two of the Falkirk founders can report better activity, but, on the whole, conditions are unimproved, and many of the smaller foundries are closed down or on short time. A Paisley firm is reported to have secured a further order for sugar-making machinery for an Indian factory. Scottish No. 3 foundry iron remains at the official minimum of 65s. f.o.t. furnaces, with 2s. 6d. per ton extra for No. 1 quality. Middlesbrough No. 3 is at 59s. 9d. f.o.t. Falkirk area, the quotation for the Glasgow area being 62s. 9d. No. 4 foundry is 1s. per ton less. Although Northamptonshire irons have been advanced in some English markets, there has been no change made in Scottish prices, quotations remaining at 57s. 6d. at Falkirk and 60s. 6d. at Glasgow for No. 3 Midland irons.

Coke.

Foundry-coke prices are unaltered at 36s. 6d. to 38s. for best-quality Durham coke, with Welsh coke at anything between 30s. and 46s. per ton, according to tonnage and quality, all delivered Birmingham and district. Market conditions show no alteration, there being little or no departure from the general policy of hand-to-mouth buying.

Steel.

Export trade is adversely affected by the American position and by the European Steel Cartel negotiations, and overseas buyers appear nervous and hesitate to commit themselves. The demand for semi-finished material has been irregular, and the tendency is for business in this department to expand. Continental competition is practically absent from the British market, and as stocks in users' hands are reduced, an increasing amount of business is going to the British works. The recent advances in the prices of Continental semi-finished steel have put business in this material out of the question so far as British users are concerned. Some improvement is noticeable in the demand for finished products on home account. The call from some sections of the engineering trades has improved lately, and more business is coming from the shipyards, although in both cases trading is below the normal.

Scrap.

Prices remain generally weak in the iron- and steel-scrap markets. In the Cleveland area, there are plentiful offers of both machinery scrap and ordinary quality at 37s. 6d. per ton, but buyers are demanding a lower level. Light castings are at 35s. per ton. In the Midlands the demand for scrap, although limited, is very steady and prices are maintained at 45s. to 47s. 6d. for heavy machinery metal in cupola sizes, good heavy pipe and plate at 40s. to 42s. 6d., and clean light metal at 37s. 6d., all delivered local works. In the Scottish market, there is only a poor demand for first-class machinery scrap at about 50s., and for ordinary cast at 46s. In South Wales heavy cast iron is easier at 42s. 6d. to 43s. 6d. Machinery scrap is also very quiet at 48s. per ton.

Metals.

Copper.—Following the flight from money into commodities in America, and the startling rise in tin, considerable speculative interest has been taken in the copper market. Buying by consumers has not been on a proportionate scale, although there is a belief that stocks of metal at the works are at a low level. One or two American mines are reported to be further curtailing their outputs, although there is no sign as yet of the general movement which was promised a month or so ago.

The week's prices have been as follow :—

Cash.—Thursday, £32 5s. to £32 7s. 6d.; Friday, £32 15s. to £32 16s. 3d.; Monday, £32 16s. 3d. to £32 17s. 6d.; Tuesday, £33 7s. 6d. to £33 8s. 9d.; Wednesday, £33 1s. 3d. to £33 2s. 6d.

Three Months.—Thursday, £32 7s. 6d. to £32 10s.; Friday, £33 to £33 1s. 3d.; Monday, £33 to £33 1s. 3d.; Tuesday, £33 11s. 3d. to £33 12s. 6d.; Wednesday, £33 6s. 3d. to £33 8s. 9d.

Tin.—Quotations in this market continue to rise. Messrs. Brandeis, Goldschmidt & Company state in their report that the advance has been a surprise both to producers and to members of the International Pool. The figures for the preceding month showed a decline in stocks of rather less than 2,000 tons, and although there had already been a good rise prices were raised steadily without any appreciable set-back, and the market remained firm throughout the week. The movement in itself has not been unexpected and may continue further, but it has been rather too sudden to be considered safe. America has been purchasing more freely than for some time. Various reasons have been given for this rise, such as the inflation of the dollar and the increased use of tin for purposes connected with the beer-brewing industry. It is probably true that the seasonable demand for tin will last rather longer for these reasons than is usually the case, but it is unfortunate that the restriction agreements are so rigid that on the one hand the Pool cannot release some of its stocks as the price advances—with a view to supporting the market if necessary when it falls—and that, on the other hand, the premium for Straits tin has been allowed to increase to about £15 per ton without any prospect of a larger output on the part of producers of this brand.

Daily quotations :—

Cash.—Thursday, £177 5s. to £177 10s.; Friday, £178 12s. 6d. to £178 17s. 6d.; Monday, £182 2s. 6d. to £182 5s.; Tuesday, £182 10s. to £182 12s. 6d.; Wednesday, £182 10s. to £182 12s. 6d.

Three Months.—Thursday, £177 17s. 6d. to £178; Friday, £179 5s. to £179 10s.; Monday, £183 to £183 5s.; Tuesday, £183 5s. to £183 7s. 6d.; Wednesday, £183 to £183 5s.

Spelter.—Quotations for this metal have been somewhat lower than might have been expected, in view of the steady trade demand which has been experienced. Galvanised sheets are still a far from good market, but slightly better conditions are reported in the hollow-ware trade. The element of uncertainty which has been disturbing the market is largely due to the impending meeting of the producers, at which the important question of output restriction is to be discussed.

Price fluctuations :—

Ordinary.—Thursday, £14 18s. 9d.; Friday, £15 2s. 6d.; Monday, £15 7s. 6d.; Tuesday, £15 8s. 9d.; Wednesday, £15 2s. 6d.

Lead.—Plentiful supplies of this metal are available. Consumption remains at a fairly good level. Prices in this section are generally regarded as being low, and the metal is being bought from an investment point of view—in spite of the fact that the market is under no artificial control.

Daily market prices :—

Soft Foreign (Prompt).—Thursday, £11 7s. 6d.; Friday, £11 17s. 6d.; Monday, £12 1s. 3d.; Tuesday, £12; Wednesday, £11 16s. 3d.

A Model Foundry.—A unique feature of the equipment of the £80,000 technical school, which was opened at Falkirk in September last, is a model foundry. This is the only school in Scotland which has this adjunct, and, recently, the first "cast" from the cupola took place. Among those present were:—Mr. George Pate, O.B.E., manager of the Carron Iron Company; Ex-Provost Shanks, Denny Iron Works; Mr. Thomas Shanks, Denny, President of the local Branch of British Foundrymen; Mr. J. Allen, secretary of the National Light Castings Industry; Mr. A. Rennie, manager of Camelon Ironworks; Mr. Hugh Carbarns, C.A., of Carron Iron Company; Mr. John Higgins, advertising manager of Carron Iron Company, and Mr. J. Coutts Morrison, Director of Education for the County of Stirlingshire. County Councillor George M'Laren cast the first ladle of molten metal. There were about 12 cwts. of metal used, and these were cast into boxes which had been prepared by the students of the continuation classes. Considerable interest was shown by the visitors in the moulding shop, which comprises a reverberatory furnace, operated by oil fuel, and a crucible furnace for melting tin and lead, in addition to the cupola furnace already mentioned. The foundry has, also, an overhead crane, capable of lifting a weight of 1½ tons.

The order which was recently placed with the Ardrossan Dockyard Company, Limited, for a 450-ton motor coaster has been cancelled. The Coastal Trade Development Council states that the cancellation is due to the proposed tax of 1d. per gallon on heavy oils. It is pointed out that one penny per gallon is approximately £1 per ton, and this, it is stated, would add from 33 to 50 per cent. and in some cases as much as 75 per cent. to the fuel bill. The order placed with Messrs. Henry Robb, Limited, Leith, for a large motor coaster for the Coast Lines has been provisionally cancelled for the same reason. It is anticipated that other orders will be cancelled if the tax is imposed.

Mr. Aldus C. Higgins, for many years treasurer of the Norton Company, U.S.A., was elected President and general manager at the annual meeting of the company.

ROOTS BLOWERS
CUPOLAS
CHARGING MACHINES
LADLES
FANS FOR ALL PURPOSES.
FOUNDRY EQUIPMENT
MOULDING MACHINES
SAND MILLS
HOISTS
Manufacturers (under licence) of the Balanced Blast System of Cupola Control.
ALLDAYS & ONIONS LTD.
GREAT WESTERN WORKS, BIRMINGHAM.
LONDON OFFICE: 9. VICTORIA STREET, S.W.1.
809

universally recognised as the leading brand of Cylinder Pig Iron
WARNER
CBR
The way to BETTER castings
WARNER & CO. LTD. CARGO FLEET MIDDLESBROUGH

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	33	1	3
Three months	33	6	3
Electrolytic	36	15	0
Tough	35	5	0
Best selected	35	15	0
Sheets	63	0	0
India	45	10	0
Wire bars	38	10	0
Do., June	38	0	0
Do., July	37	10	0
Ingot bars	38	10	0
H.C. wire rods	39	10	0
Off. av. cash, April	29	12	5⅛
Do., 3 mths., April	29	16	6¾
Do., Sttlmnt., April	29	12	9⅛
Do., Electro, April	33	19	4½
Do., B.S., April	32	14	4½
Do., wire bars, April	34	5	1⅝
Solid drawn tubes			9½d.
Brazed tubes			9½d.
Wire			6½d.

BRASS.

Solid drawn tubes	8⅜d.
Brazed tubes	10½d.
Rods, drawn	7⅞d.
Rods, extd. or rlld.	4½d.
Sheets to 10 w.g.	7½d.
Wire	7⅜d.
Rolled metal	7d.
Yellow metal rods	4½d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5½d.

TIN.

	£	s.	d.
Standard cash	182	10	0
Three months	183	0	0
English	183	15	0
Bars	185	5	0
Straits	196	10	0
Australian	191	10	0
Eastern	203	5	0
Banca (nom.)			—
Off. av. cash, April	158	0	4⅛
Do., 3 mths., April	158	15	1⅝
Do., Sttlmt., April	158	0	3⅓

SPELTER.

	£	s.	d.
Ordinary	15	2	6
Remelted	15	10	0
Hard	13	0	0
Electro 99.9	17	15	0
English	16	2	6
India	14	10	0
Zinc dust	19	0	0
Zinc ashes	2	5	0
Off. aver., April	15	1	7⅛
Aver. spot, April	14	19	0⅓

LEAD.

	£	s.	d.
Soft foreign ppt.	11	16	3
Empire	12	5	0
English	13	5	0
Off. average, April	10	19	11⅓
Average spot, April	10	17	5⅙

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	24	0	0
Do., V.M. ex-whse.	23	5	0
Rods	26	0	0
Boiler plates			—
Battery plates			—

ANTIMONY.

	£	s.	d.	£	s.	d.
English	37	10	0 to	42	10	0
Chinese				27	0	0
Crude						—

QUICKSILVER.

	£	s.	d.	£	s.	d.
Quicksilver	8	0	0 to	9	5	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.	£	s.	d.
Ferro silicon—						
25%				7	15	0
45/50%				13	17	6
75%				19	12	6
Ferro-vanadium—						
35/50%				12/8 lb. Va.		
Ferro-molybdenum—						
70/75% carbon-free of Mo.				6/3 per lb.		
Ferro-titanium—						
23/25% carbon-free				10d. lb.		
Ferro-phosphorus, 20/25%				£17	17	6
Ferro-tungsten—						
80/85%				1/6 lb.		
Tungsten metal powder—						
98/99%				1/9 lb.		
Ferro-chrome—						
2/4% car.				£29	5	0
4/6% car.				£22	15	0
6/8% car.				£21	15	0
8/10% car.				£21	0	0
Ferro-chrome—						
Max. 2% car.				£33	10	0
Max. 1% car.				£36	5	0
Max. 0.70% car.				£40	2	6
70% carbon-free				11d. lb.		
Nickel—99.5/100%				£225 to £230		
"F" nickel shot				£202	10	0
Ferro-cobalt				5/9 lb.		
Aluminium 98/99%				£100	0	0
Metallic chromium—						
96/98%				2/8 lb.		
Ferro-manganese (net)—						
76/80% loose	£10	15	0 to £11	5	0	
76/80% packed	£11	15	0 to £12	5	0	
76/80% export	(nom.)			£9	15	0
Metallic manganese—						
94/96% carbon-free				1/4 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 1/16 in.	1/– lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/– lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

South Wales—	£	s.	d.	£	s.	d.
Heavy steel				2	3	6
Bundled steel and shrngs.	1	17	6 to 2	1	0	
Mixed iron and steel	2	0	0 to 2	1	6	
Heavy cast iron	2	2	6 to 2	3	6	
Good machinery				2	8	0
Cleveland—						
Heavy steel				1	15	0
Steel turnings				1	11	6
Cast-iron borings				1	2	0
Heavy forge				2	10	0
W.I. piling scrap				2	2	6
Cast-iron scrap				1	17	6
Midlands—						
Light cast-iron scrap				1	17	6
Heavy wrought iron	2	5	0 to 2	7	6	
Steel turnings, f.o.r.				1	4	6
Scotland—						
Heavy steel	1	17	6 to 1	18	6	
Ordinary cast iron				2	6	0
Engineers' turnings				1	11	6
Cast-iron borings				1	12	6
Wrought-iron piling				2	2	6
Heavy machinery				2	10	0

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	23	0	0
Brass	16	0	0
Lead (less usual draft)	9	10	0
Tea lead	8	0	0
Zinc	9	0	0
New aluminium cuttings	74	0	0
Braziery copper	19	0	0
Gunmetal	20	0	0
Hollow pewter	90	0	0
Shaped black pewter	70	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	65/–
Foundry No. 3	62/6
,, at Falkirk	59/9
,, at Glasgow	62/9
Foundry No. 4	61/6
Forge No. 4	61/6
Hematite No. 1, f.o.t.	59/6
Hematite M/Nos., f.o.t.	59/–
N.W. Coast—	
Hem. M/Nos. d/d Glas.	68/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/–
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	62/–
,, No. 3 fdry.	66/–
Northants forge	58/6
,, fdry. No. 3	62/6
,, fdry. No. 1	65/6
Derbyshire forge	62/–
,, fdry. No. 3	66/–
,, fdry. No. 1	69/–
Scotland—	
Foundry No. 1	67/6
,, No. 3	65/–
Hem. M/Nos. d/d	66/–
Sheffield (d/d district)—	
Derby forge	59/6
,, fdry. No. 3	63/6
Lincs forge	59/6
,, fdry. No. 3	63/6
E.C. hematite	73/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	67/–
Staffs fdry. No. 3	67/–
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/–
Dalzell, No. 3 (special)	102/6 to 105/–
Glengarnock, No. 3	82/–
Clyde, No. 3	82/–
Monkland, No. 3	82/–
Summerlee, No. 3	82/–
Eglinton, No. 3	82/–
Gartsherrie, No. 3	82/–
Shotts, No. 3	82/–

FINISHED IRON AND STEEL.

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.)	9	0	0 to	9	15	0
Nut and bolt iron	7	10	0 to	8	0	0
Hoops	10	10	0 to	12	0	0
Marked bars (Staffs) f.o.t.				12	0	0
Gas strip	10	10	0 to	12	0	0
Bolts and nuts, ¾ in. × 4 in.				12	17	6
Steel—						
Plates, ship, etc.	8	15	0 to	8	17	6
Boiler plts.				8	5	0
Chequer plts.				10	7	6
Angles				8	7	6
Tees				9	7	6
Joists				8	15	0
Rounds and squares, 3 in. to 5½ in.				9	7	6
Rounds under 3 in. to ⅜ in. (Untested)	6	15	0 & up.			
Flats—8 in. wide and over				8	12	6
,, under 8 in. and over 5 in.				8	17	6
Rails, heavy	8	5	0 to	8	10	0
Fishplates				12	0	0
Hoops (Staffs)	9	10	0 & up.			
Black sheets, 24g. (10-t. lots)	9	10	0			
Galv. cor. shts. ,,				11	15	0
Galv. flat shts. ,,				12	5	0
Galv. fencing wire, 8g. plain				14	0	0
Billets, soft	5	0	0 to	5	7	6
Billets, hard	6	12	6 to	7	2	6
Sheet bars	4	15	0 to	5	2	6
Tin bars				4	15	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	10½d.
Sheet to 10 w.g.	11½d.
Wire	11⅝d.
Rods	10½d.
Tubes	15d.
Castings	12½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	14.34
No. 2 foundry, Valley	14.50
No. 2 foundry, Birm.	12.00
Basic	15.39
Bessemer	16.89
Malleable	16.39
Grey forge	16.39
Ferro-mang. 80%, seaboard	68.00
O.-h. rails, h'y, at mill	40.00
Billets	26.00
Sheet bars	26.00
Wire rods	35.00
	Cents.
Iron bars, Phila.	1.86
Steel bars	1.60
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.60
Steel hoops	1.50
Sheets, black, No. 24	2.00
Sheets, galv., No. 24	2.70
Wire nails	1.85
Plain wire	2.10
Barbed wire, galv.	2.35
Tinplates, 100-lb. box	$4.25

COKE (at ovens).

Welsh foundry	20/– to 22/6
,, furnace	16/– to 17/–
Durham and Northumberland—	
,, foundry	21/– to 25/–
,, furnace	13/3
Midlands, foundry	—
,, furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box		16/– to 16/6
,,	28×20	,,	32/– to 33/–
,,	20×10	,,	22/10½ to 23/6
,,	18¾×14	,,	16/9 to 17/3
C.W.	20×14	,,	15/–
,,	28×20	,,	30/3
,,	20×10	,,	—
,,	18¾×14	,,	—

SWEDISH CHARCOAL IRON & STEEL.

	£	s.	d.	£	s.	d.
Pig-iron	£6	0	0 to	£7	0	0
Bars-hammered, basis	£16	10	0 to	£17	0	0
Bars and nail-rods, rolled, basis	£15	17	6 to	£16	5	0
Blooms	£10	0	0 to	£12	0	0
Keg steel	£32	0	0 to	£33	0	0
Faggot steel	£18	0	0 to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0 to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.	
May	4 ..	32	5	0	inc. 20/–
,,	5 ..	32	15	0	,, 10/–
,,	8 ..	32	16	3	,, 1/3
,,	9 ..	33	7	6	11/3
,,	10 ..	33	1	3	dec. 6/3

Electrolytic Copper.

		£	s.	d.	
May	4 ..	35	15	0	inc. 10/–
,,	5 ..	36	10	0	,, 15/–
,,	8 ..	36	10	0	No change
,,	9 ..	37	0	0	inc. 10/–
,,	10 ..	36	15	0	dec. 5/–

Standard Tin (cash).

		£	s.	d.	
May	4 ..	177	5	0	inc. 70/–
,,	5 ..	178	12	6	,, 27/6
,,	8 ..	182	2	6	,, 70/–
,,	9 ..	182	10	0	,, 7/6
,,	10 ..	182	10	0	No change

Tin (English ingots).

		£	s.	d.	
May	4 ..	178	15	0	inc. 70/–
,,	5 ..	180	0	0	,, 25/–
,,	8 ..	183	10	0	,, 70/–
,,	9 ..	183	15	0	,, 5/–
,,	10 ..	183	15	0	No change

Spelter (ordinary).

		£	s.	d.	
May	4 ..	14	18	9	inc. 2/6
,,	5 ..	15	2	6	,, 3/9
,,	8 ..	15	7	6	,, 5/–
,,	9 ..	15	8	9	,, 1/3
,,	10 ..	15	2	6	dec. 6/3

Spelter (Electro, 99.9 per cent.).

		£	s.	d.	
May	4 ..	17	7	6	No change
,,	5 ..	17	10	0	inc. 2/6
,,	8 ..	17	15	0	,, 5/–
,,	9 ..	17	15	0	No change
,,	10 ..	17	15	0	,, ,,

Zinc Sheets (English).

		£	s.	d.	
May	4 ..	24	0	0	No change
,,	5 ..	24	0	0	,, ,,
,,	8 ..	24	0	0	,, ,,
,,	9 ..	24	0	0	,, ,,
,,	10 ..	24	0	0	,, ,,

Lead (English).

		£	s.	d.	
May	4 ..	12	15	0	inc. 5/–
,,	5 ..	13	5	0	,, 10/–
,,	8 ..	13	10	0	,, 5/–
,,	9 ..	13	10	0	No change
,,	10 ..	13	15	0	dec. 5/–

AVERAGE PRICES OF GALVANISED CORRUGATED SHEETS (NORTH OF ENGLAND).

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1903	11 5 0	11 5 0	11 5 0	11 5 0	11 10 0	11 10 0	11 10 0	11 10 0	11 5 0	11 5 0	11 5 0	11 5 0	11 7 1
1904	11 5 0	11 5 0	11 5 0	11 5 0	10 15 0	10 15 0	10 15 0	10 15 0	10 5 0	10 5 0	10 5 0	10 5 0	10 16 0
1905	10 7 6	10 7 6	10 7 6	10 7 6	10 7 6	10 7 6	10 7 6	11 0 0	11 0 0	11 5 0	11 15 0	12 0 0	10 15 0
1906	12 12 6	12 12 6	12 12 6	12 7 6	12 7 6	12 7 6	12 12 6	12 12 6	12 15 0	12 15 0	12 15 0	13 5 0	12 13 11½
1907	13 5 0	13 5 0	13 15 0	13 15 0	13 15 0	13 15 0	13 17 6	13 17 6	13 17 6	13 2 6	13 2 6	13 2 6	13 10 10
1908	13 2 6	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 11 0½
1909	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	10 10 0	11 0 0	11 0 0	11 0 0	11 0 0	11 16 8
1910	11 15 0	12 5 0	12 5 0	11 15 0	11 10 0	11 10 0	11 12 6	11 12 6	11 12 6	11 12 6	11 10 0	11 10 0	11 13 4
1911	11 5 0	11 1 3	10 15 0	10 15 0	10 13 9	10 10 0	10 13 9	11 0 0	11 5 0	11 5 0	11 5 0	11 7 0	10 19 7½
1912	11 10 0	11 10 0	11 10 0	11 15 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 12 6	12 18 0	12 15 0	12 2 11½
1913	12 15 0	12 15 0	12 15 0	12 11 3	11 18 0	11 15 0	11 15 0	11 15 0	11 15 0	11 3 0	11 0 0	11 2 6	11 18 4
1914	11 7 0	11 7 6	11 7 6	11 5 7½	11 2 6	10 15 0	10 15 0	12 17 6	14 2 0	13 7 0	11 15 7	11 2 6	11 16 0
1915	11 10 8½	13 12 6	14 8 9	15 0 6	17 17 6	20 17 6	20 17 6	20 6 3	17 12 6	18 1 0	22 13 9	25 2 0	18 3 4½
1916	26 5 0	27 12 6	28 0 0	28 5 0	29 0 0	29 0 0	28 15 0	28 3 0	28 15 0	28 15 0	28 15 0	28 15 0	28 6 8½
1917	28 15 0	28 15 0	28 15 0	28 15 0	28 15 0	28 15 0	28 15 0	28 15 0	28 15 0	28 0 0	28 0 0	28 0 0	28 11 3
1918	28 5 0	28 15 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	28 13 4
1919	29 0 0	29 0 0	29 0 0	28 0 0	28 10 0	27 7 6	27 5 0	29 3 0	32 0 0	33 0 0	36 10 0	40 8 4	31 5 3½
1920	46 10 0	49 15 0	53 15 0	56 0 0	55 10 0	54 10 0	52 10 0	48 10 0	44 3 4	39 2 6	35 17 6	30 8 0	47 4 3
1921	28 10 0	25 17 6	24 5 0	23 3 4	22 0 0	22 0 0	23 10 0	21 12 6	20 0 0	18 15 0	18 3 9	17 2 0	22 1 7
1922	16 17 6	15 13 9	16 3 0	16 10 0	16 4 4½	15 15 6	15 16 3	16 16 0	16 8 9	16 6 3	17 1 0	17 7 6	16 7 5½
1923	18 3 1½	19 1 11½	19 8 0	19 10 0	19 7 0	19 1 3	18 0 0	18 13 1½	19 0 0	19 3 9	19 2 6	18 19 4½	18 19 2
1924	18 13 6	18 9 4½	18 5 0	17 15 11½	17 3 0	17 19 4½	18 7 6	18 8 1½	18 8 1½	17 19 6	17 11 3	17 10 0	18 0 10½
1925	17 8 6	17 1 6½	16 9 4½	16 12 0	16 9 8½	16 9 4½	16 0 6	16 1 10½	16 5 0	16 7 0	16 12 6	16 15 0	16 11 0½
1926	16 14 4½	16 5 7½	16 0 6	15 11 10½	15 11 3	16 0 0	16 16 0	16 18 9	16 14 0	16 18 9	17 10 0	16 19 0	16 10 0½
1927	16 3 1	15 7 6	15 3 3	15 3 1½	14 14 4½	14 11 6	14 1 10½	14 0 0	13 19 6	13 16 10½	13 13 1½	13 3 9	14 9 10
1928	13 0 0½	13 2 6	13 6 0	13 2 6	13 3 0	13 6 9	13 11 3	13 10 0	13 10 7½	13 12 6	13 11 6	13 10 0	13 8 8½
1929	13 11 0	13 13 1½	13 12 9½	13 10 11½	13 9 3	13 8 9	13 11 6	13 7 6	13 7 6	13 5 6	12 18 9	12 12 9½	13 7 5½
1930	12 5 0	11 15 0	11 19 6	11 18 7	11 18 0	11 17 6	11 17 6	11 17 6	11 16 3	11 12 6	11 8 9	11 5 0	11 15 11½
1931	11 4 0	11 0 0	11 0 0	11 0 0	10 13 9	9 18 9	9 13 0	9 5 3½	8 19 0½	9 16 0	9 8 9	9 4 0½	10 1 10½
1932	9 2 9	9 14 4½	9 16 0	9 13 9	9 12 6	9 12 6	9 11 0	9 4 4½	9 11 3	10 12 6	11 5 0	11 7 0	9 18 7
1933	11 15 0	11 15 0	11 15 0	11 15 0	—	—	—	—	—	—	—	—	—

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

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